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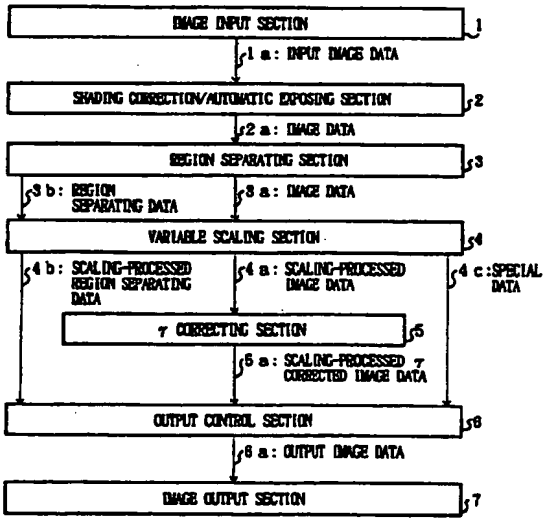
(54) Method an apparatus for image interpolation

(57) In an image processing method, an image is read by an image processing apparatus such as a digital copying machine and the read image is divided into blocks composed of a plurality of picture elements. Thereafter, interpolation is performed on a target picture element so that the image is scaled. Then, in the above image processing method, region segmentation data, which represent possibilities of characters, photographs and mesh dots of the target picture element of the image, are detected in a region segmentation section of the image processing apparatus, and the interpolated picture element data of the target picture element are computed by a variable scaling section according to an equation in which density of a plurality of adjacent picture elements in the vicinity of the target picture element are inputted. At this time, a weights of the density of each adjacent picture element in the equation is adjusted based upon the result detected by the region segmentation means. As a result, even if characters, photographs and mesh dots coexist in an image read by a scanner, the image is scaled according to the characters, photographs and mesh dots, thereby preventing deterioration in image quality.

FIG. 1



EP 0 785 529 A1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/01853

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl⁶ G06T3/40, H04N1/387

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl⁶ G06T3/40, H04N1/387

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996
Kokai Jitsuyo Shinan Koho 1971-1999

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 5-94521, A (Canon Inc.), 16 April, 1993 (16. 04. 93) (Family: none)	1-3 9-11 17-19
Y	JP, 5-252385, A (Matsushita Electric Industrial Co., Ltd.), 28 September, 1993 (28. 09. 93) (Family: none)	1-3 9-11 17-19
Y	JP, 4-340671, A (Hitachi,Ltd.), 27 November, 1992 (27. 11. 92) (Family: none)	3 11 19

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 July, 1999 (02. 07. 99)	27 July, 1999 (27. 07. 99)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

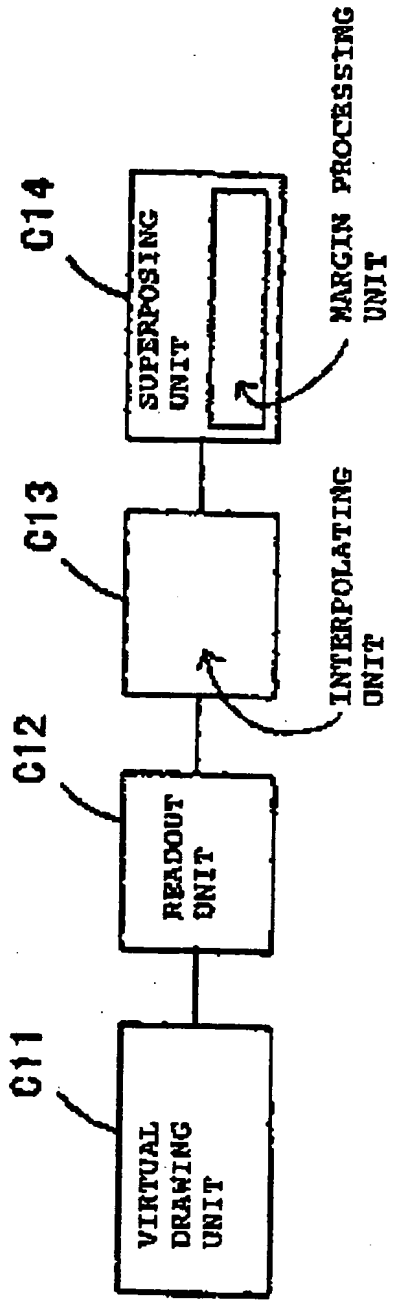
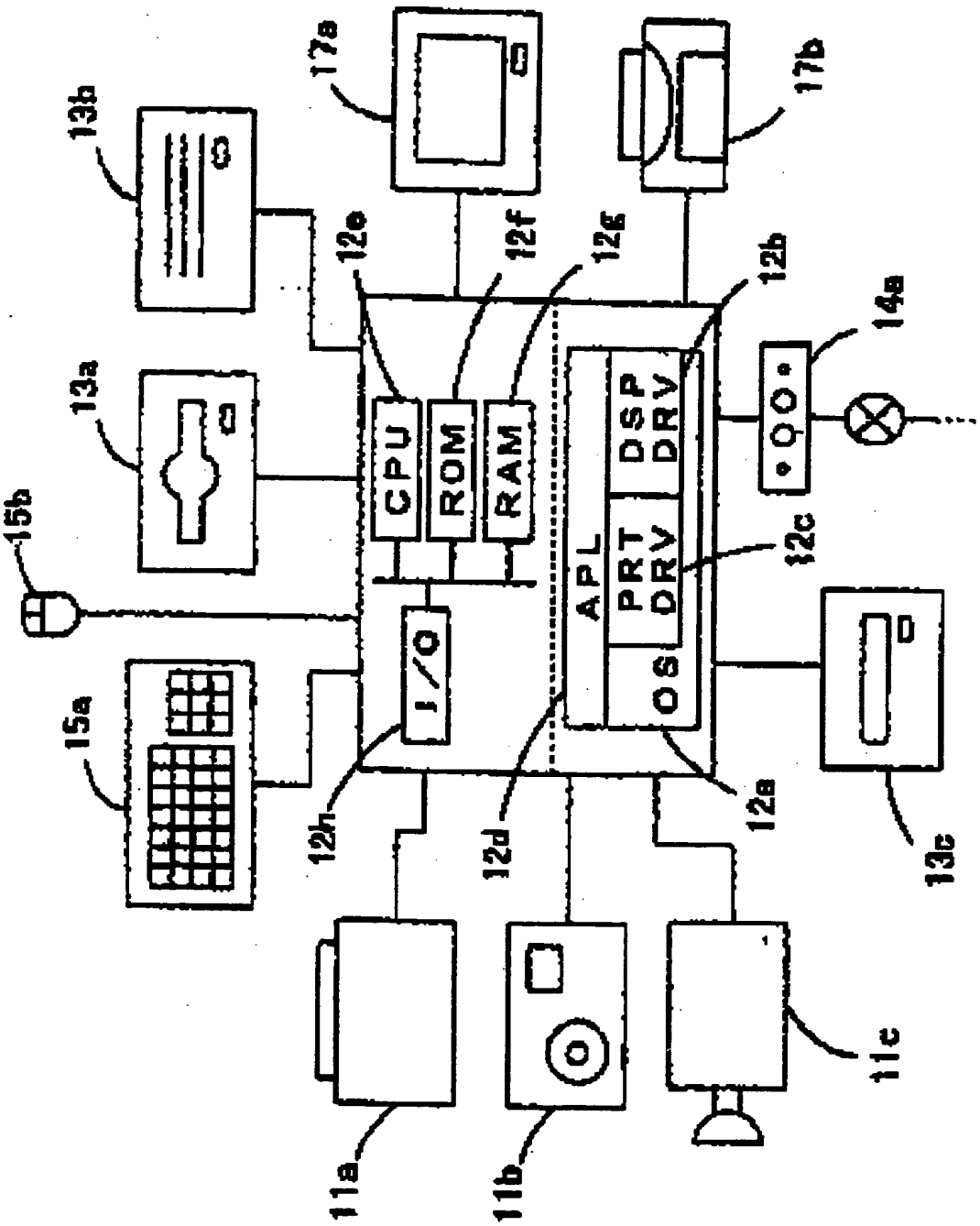


Fig. 1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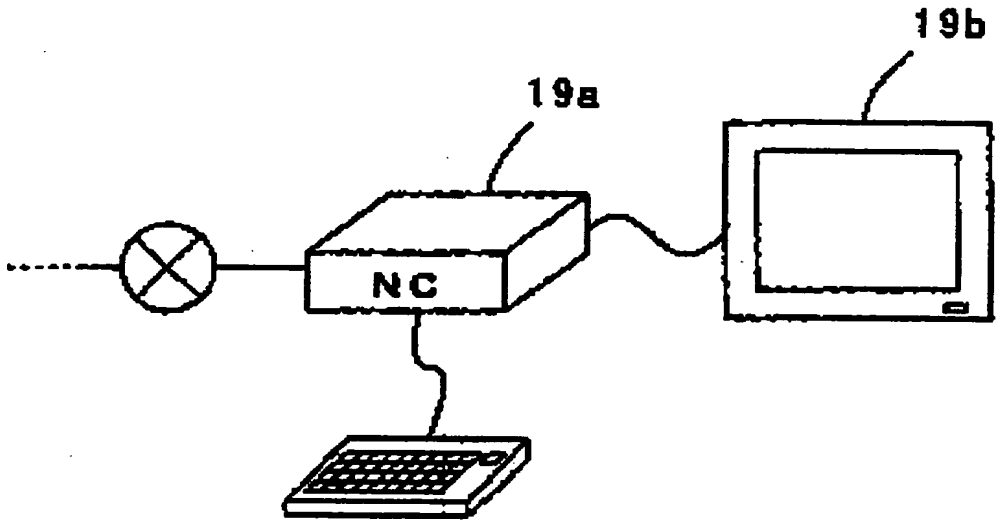
11c

Fig. 2



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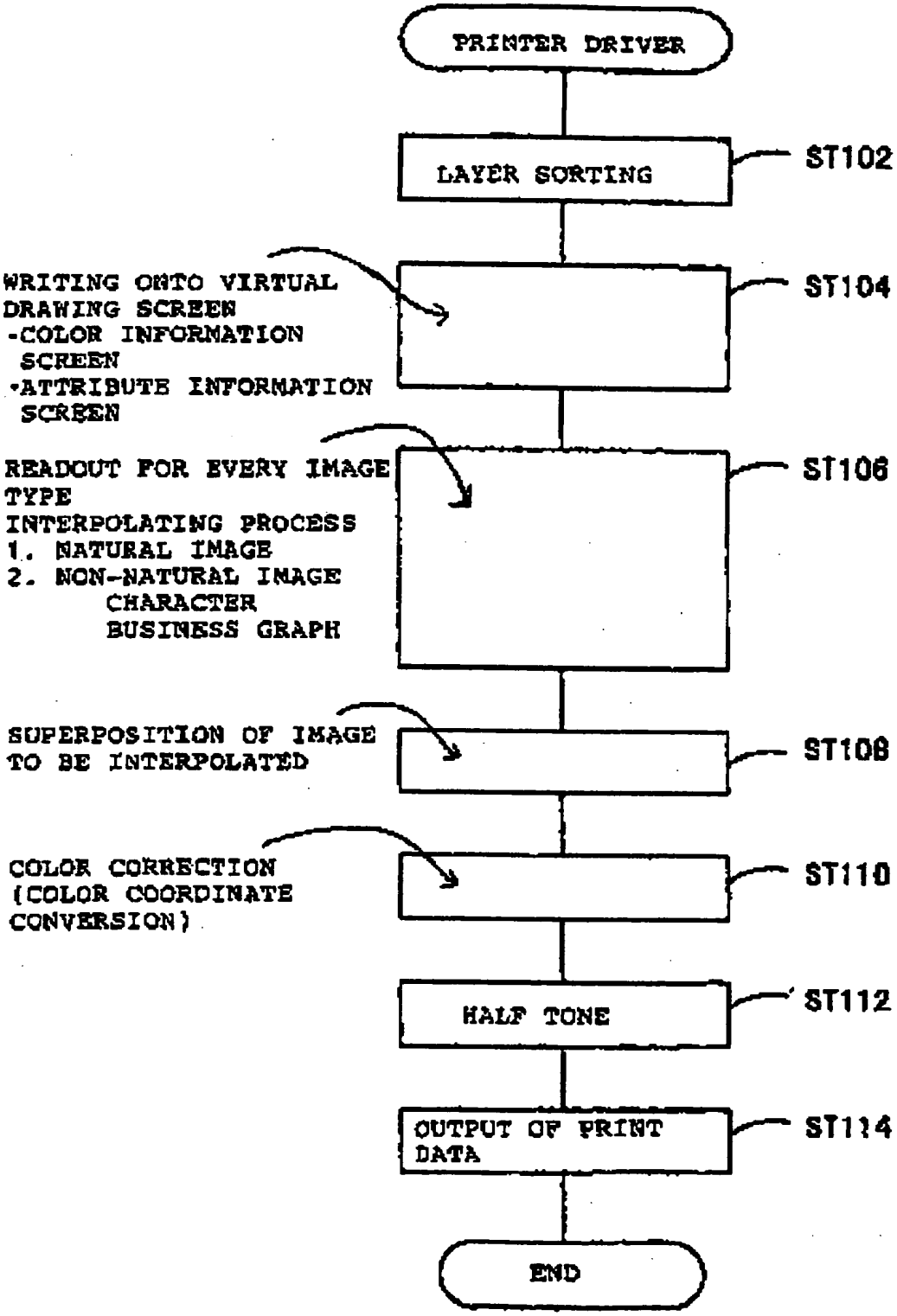
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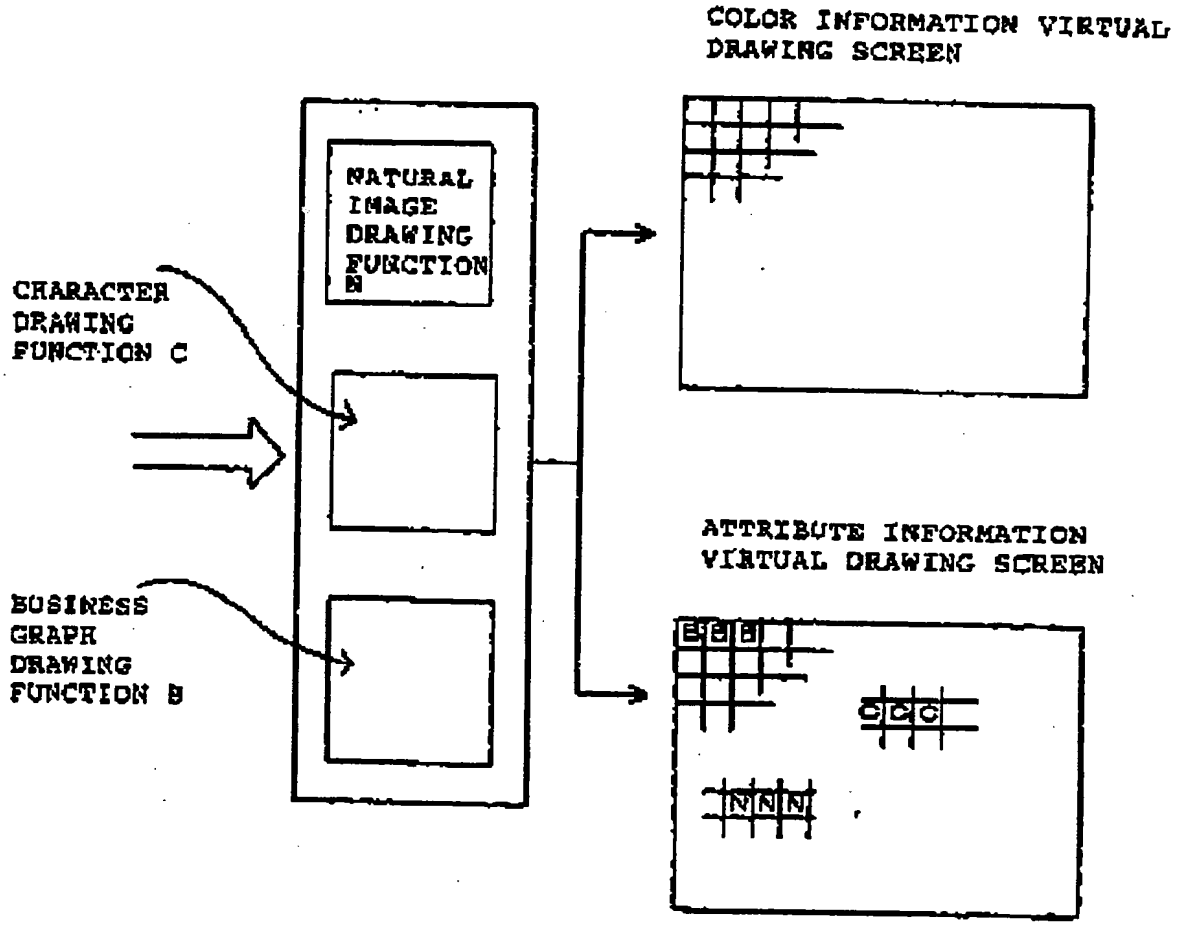
WRITING ONTO VIRTUAL DRAWING SCREEN
-COLOR INFORMATION SCREEN
-ATTRIBUTE INFORMATION SCREEN
ST104
READOUT FOR EVERY IMAGE TYPE
INTERPOLATING PROCESS
1. NATURAL IMAGE
2. NON-NATURAL IMAGE
CHARACTER
BUSINESS GRAPH
ST106
SUPERPOSITION OF IMAGE TO BE INTERPOLATED
ST108
COLOR CORRECTION (COLOR COORDINATE CONVERSION)
ST110
HALF TONE
ST112
OUTPUT OF PRINT DATA
ST114
END

Fig. 4



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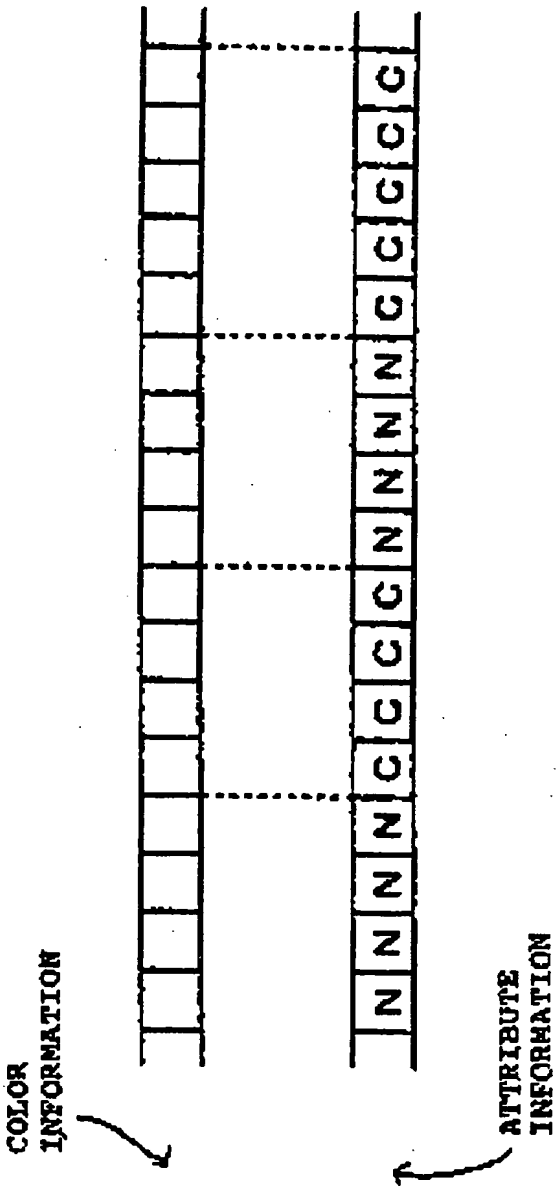
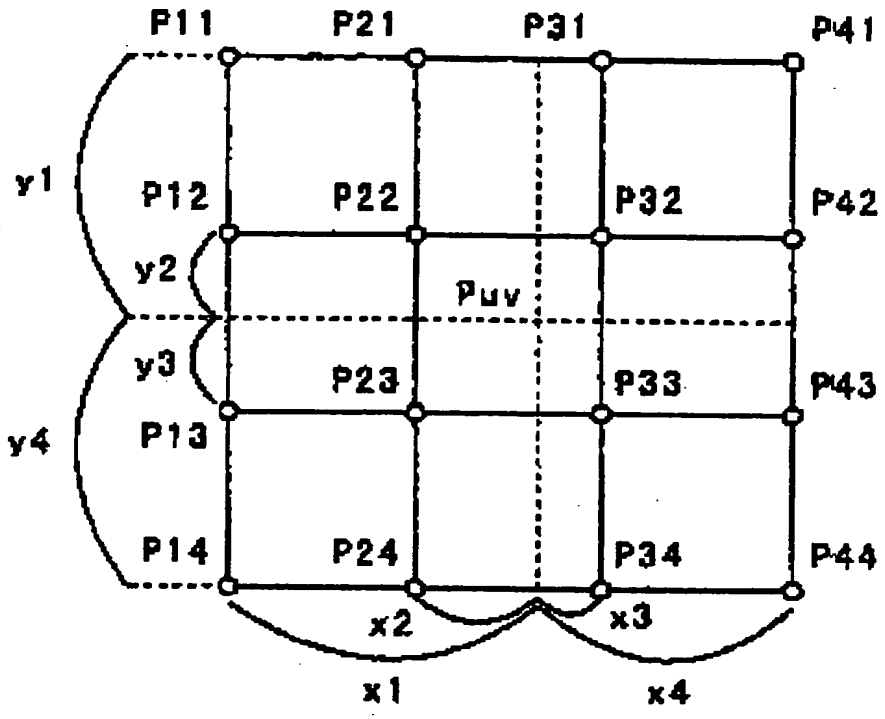

COLOR INFORMATION
ATTRIBUTE INFORMATION
N N N C C C C C C C
N N N N N N C C C C

Fig. 6A

Fig. 6B



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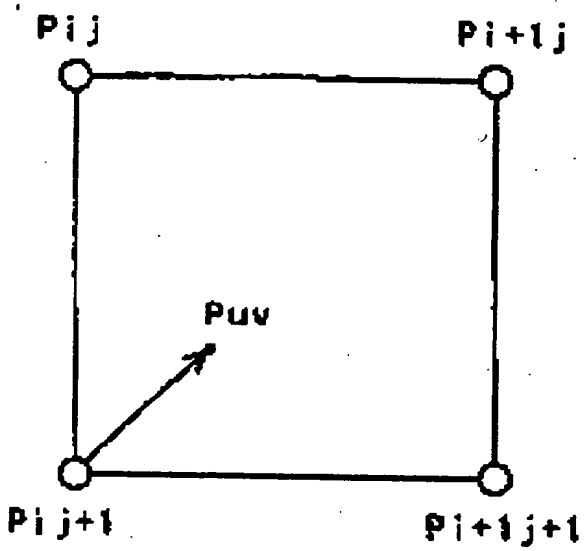

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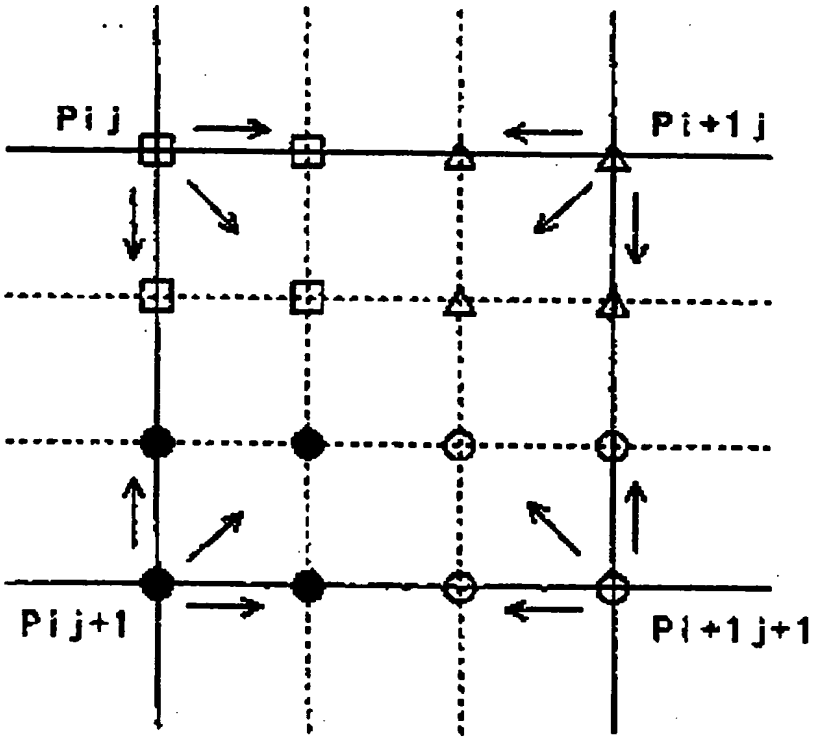

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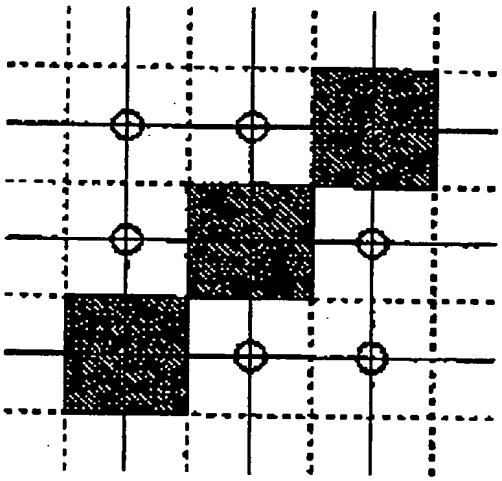
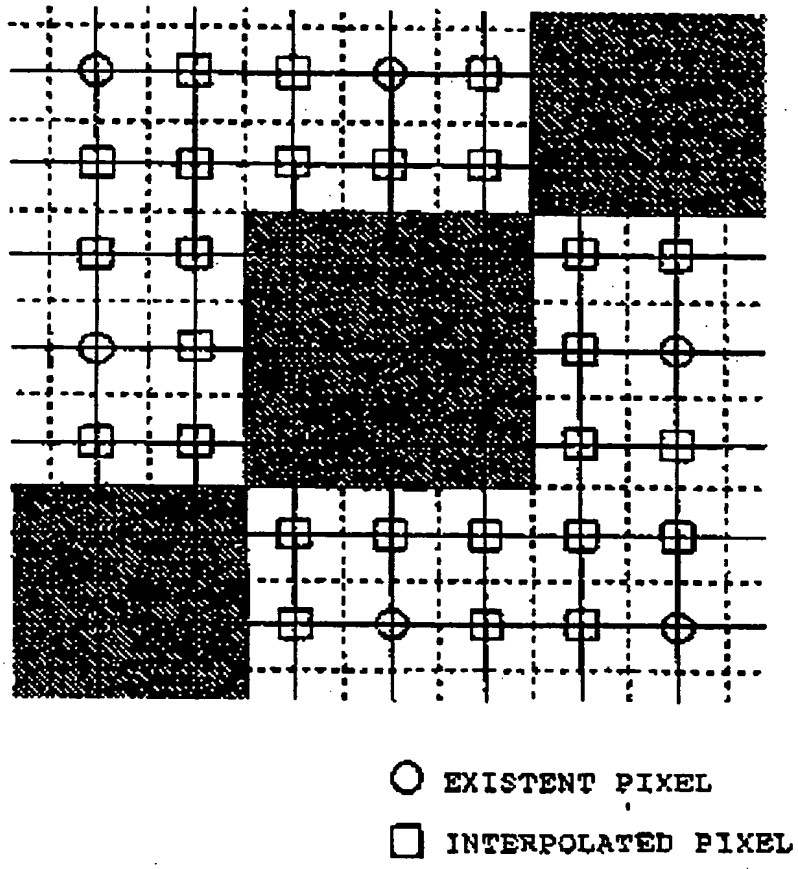


○ EXISTENT PIXEL

Fig. 10



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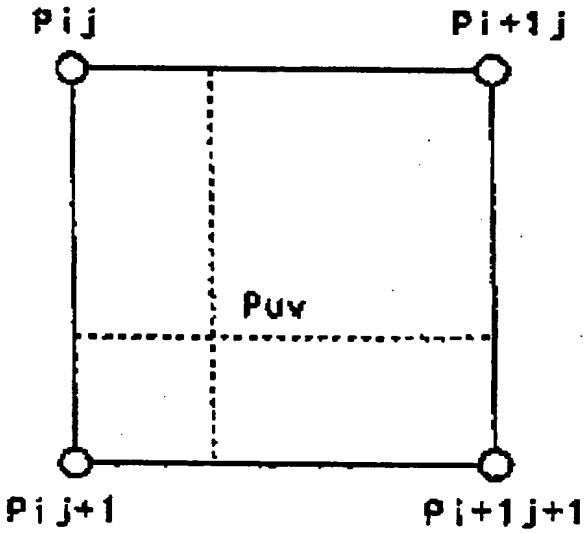

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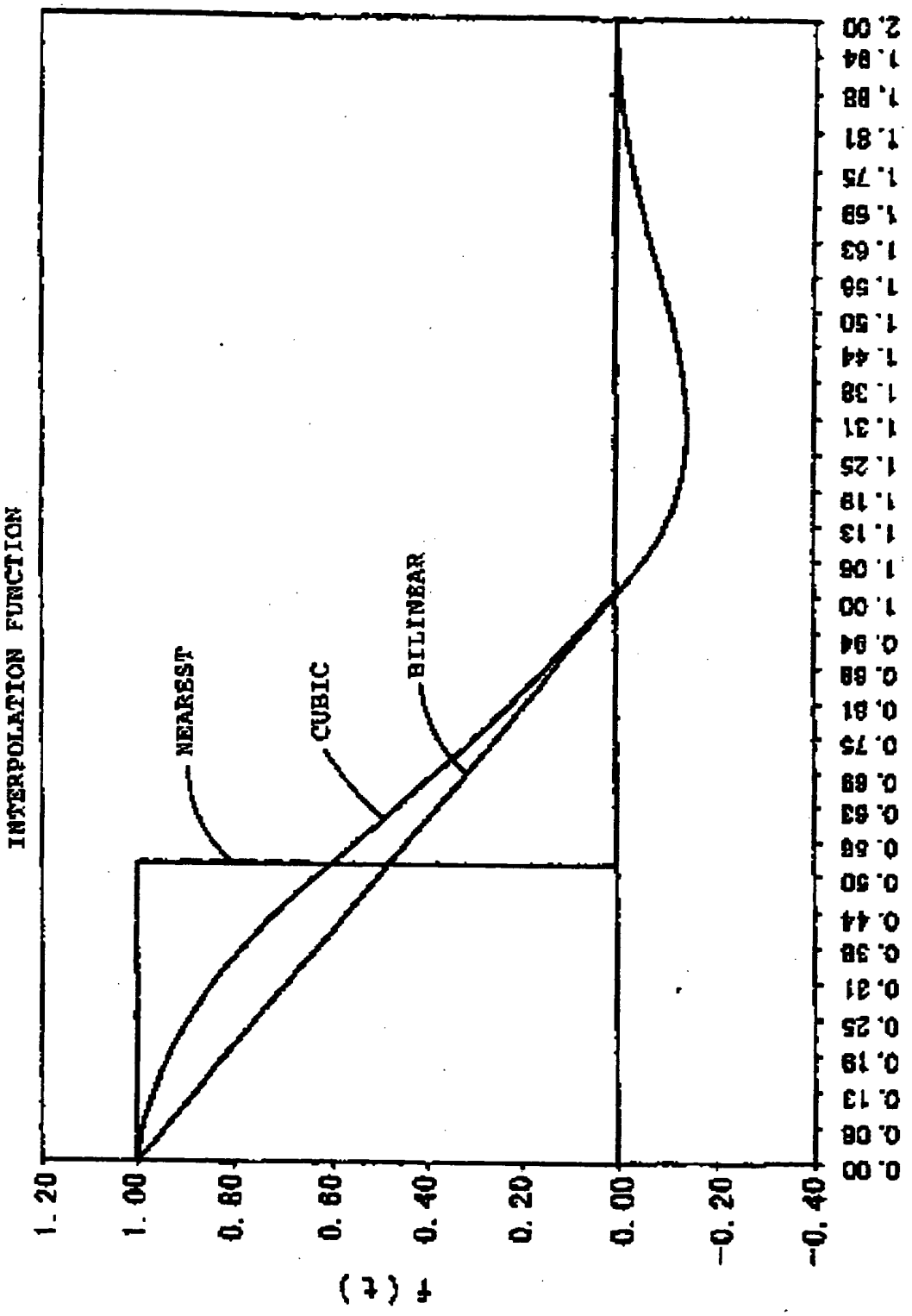

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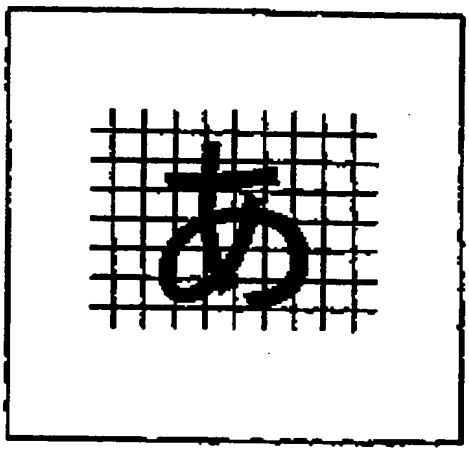

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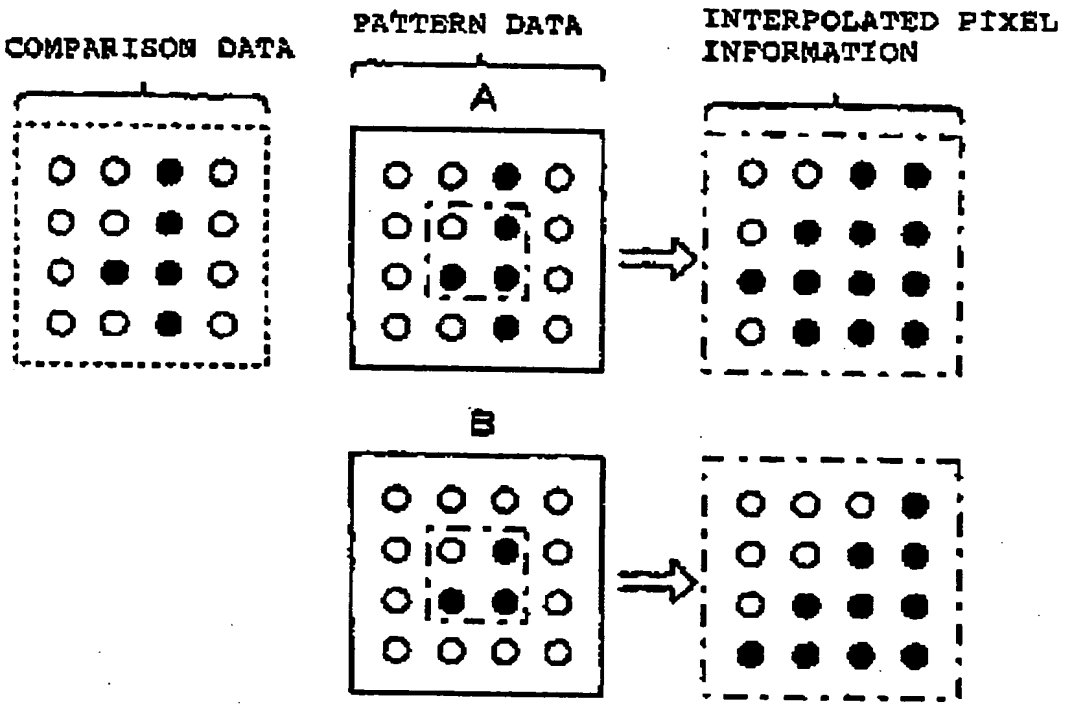

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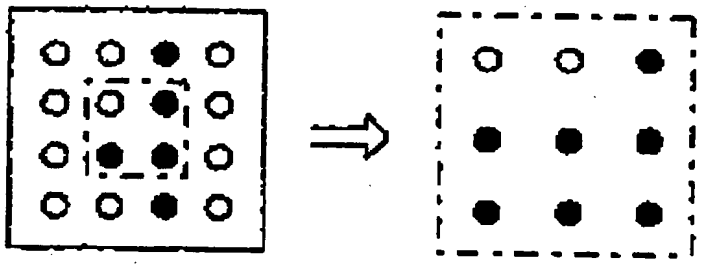

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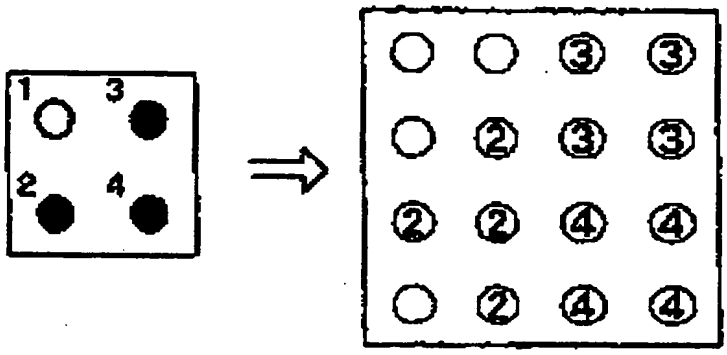


Fig. 17

Fig. 18A

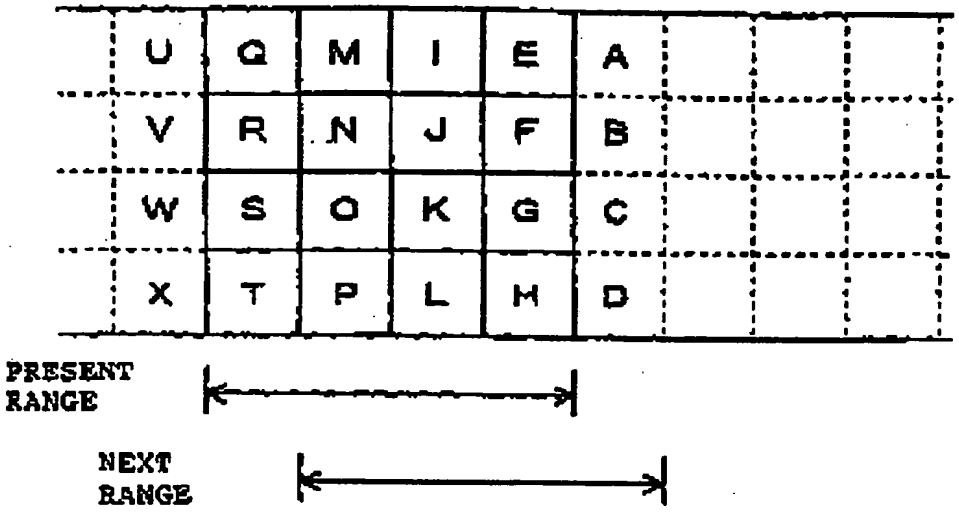


Fig. 18B

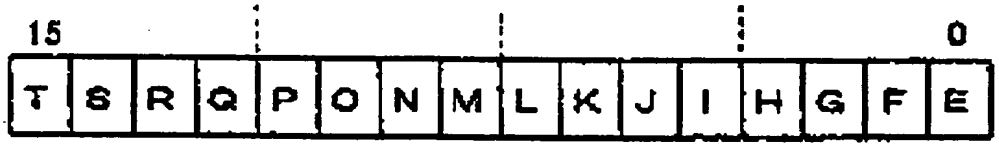
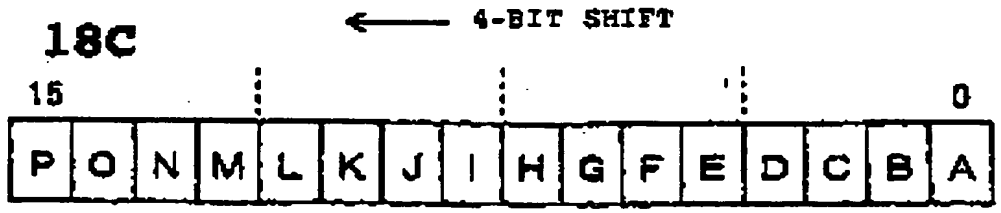
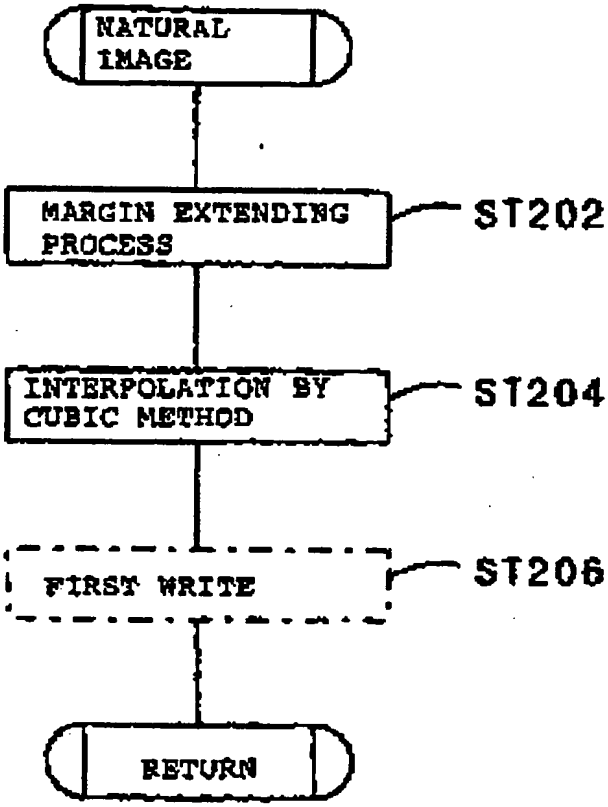


Fig. 18C





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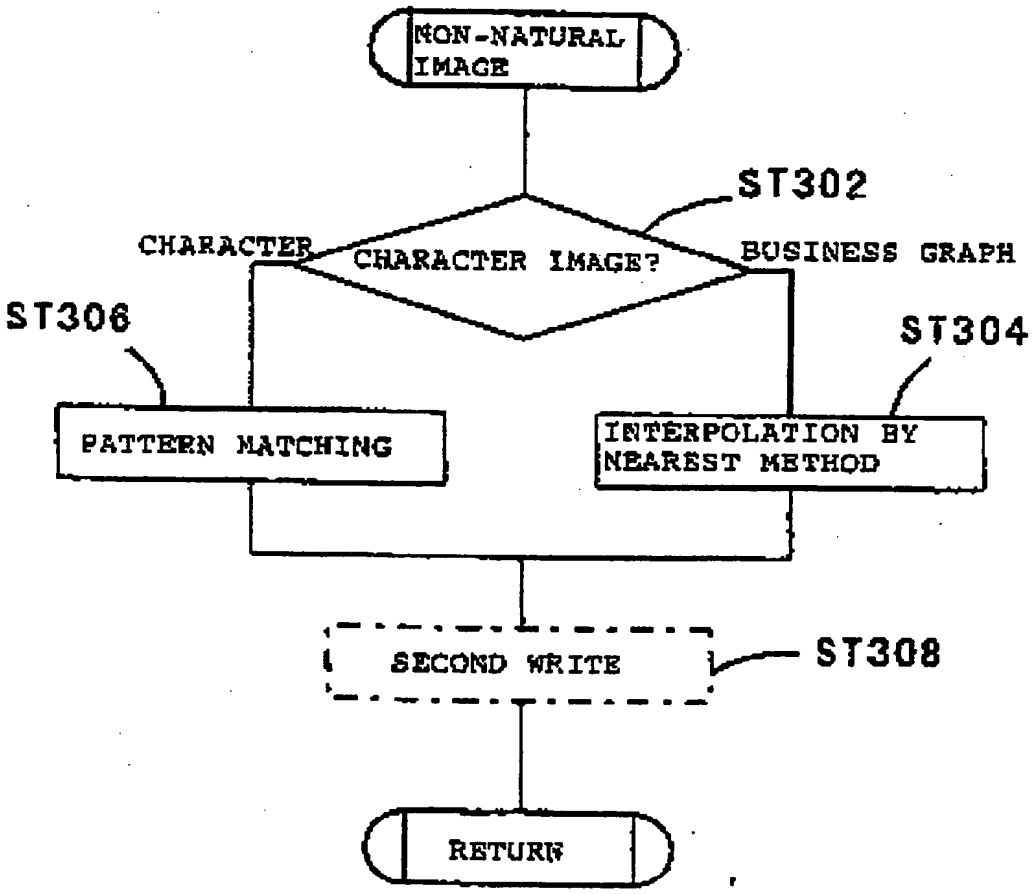

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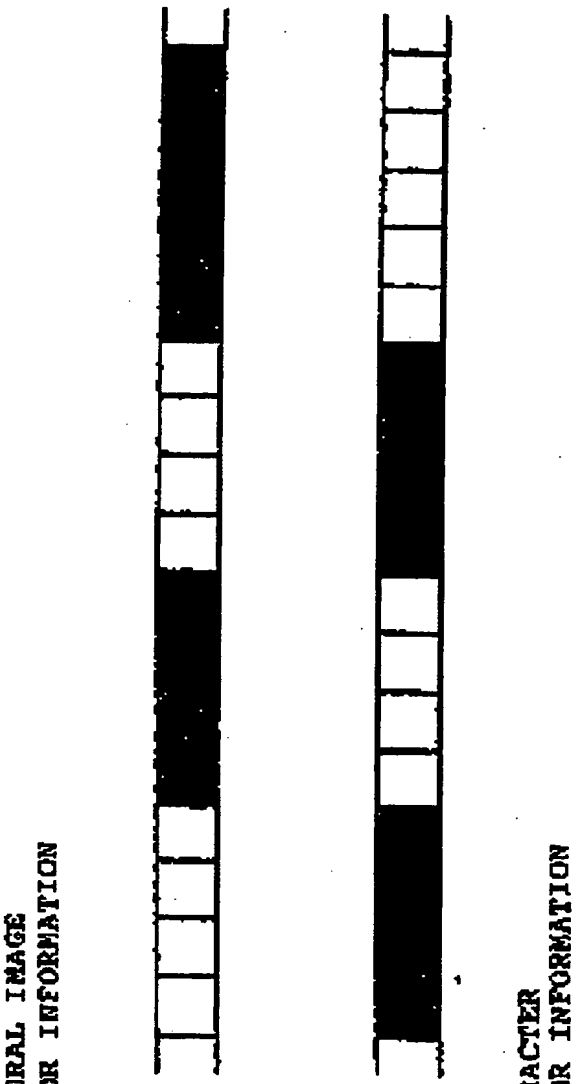

Fig. 21A

Fig. 21B

NATURAL IMAGE
COLOR INFORMATION
INTERPOLATING PROCESS
BUFFER

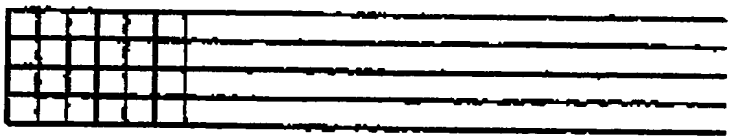

Fig. 22A

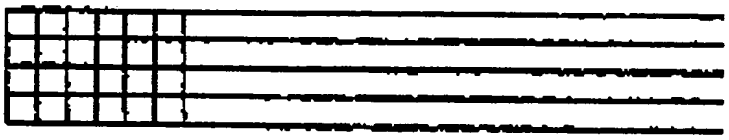

Fig. 22B

CHARACTER
COLOR INFORMATION
INTERPOLATING PROCESS
BUFFER

Fig. 23A

CO-EXISTENT

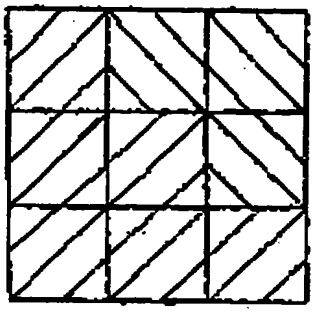

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Fig. 23B

NATURAL IMAGE

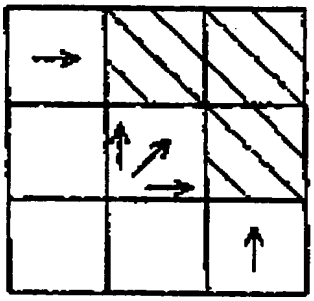

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Fig. 23D

NON-NATURAL IMAGE

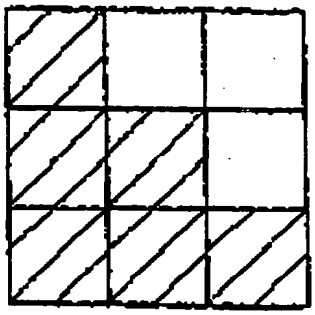


Fig. 23C

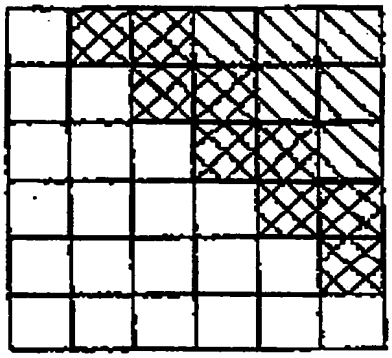


Fig. 23E

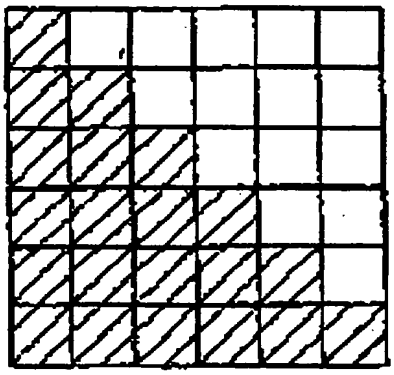
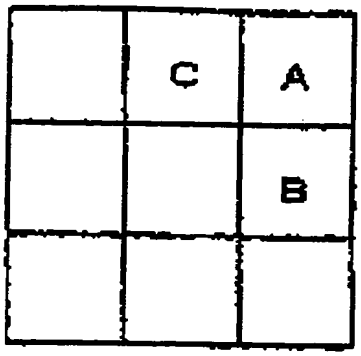
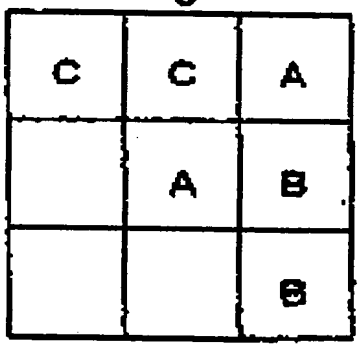


Fig. 24A



MARGINAL EXTENSION

Fig. 24B



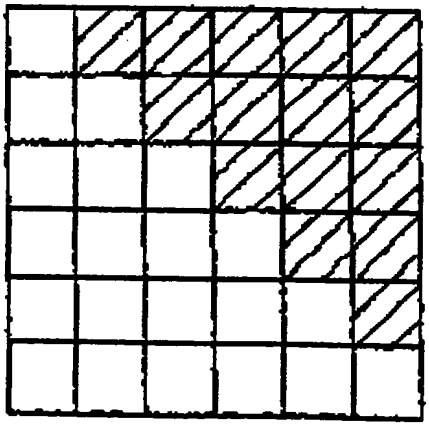


Fig. 24C

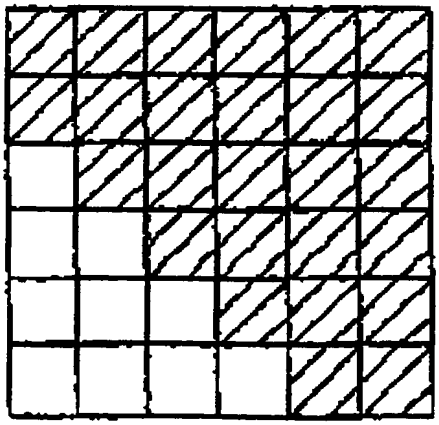
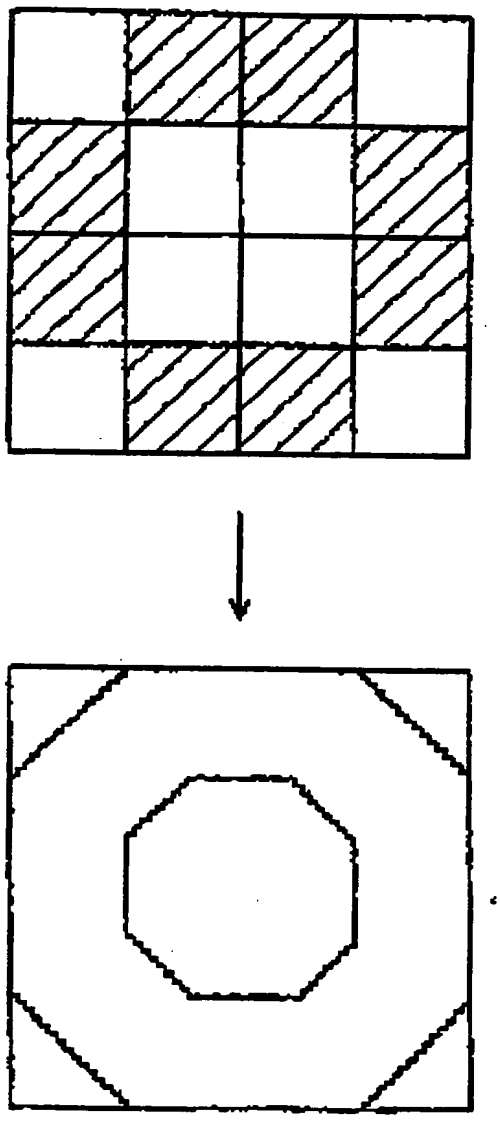


Fig. 24D



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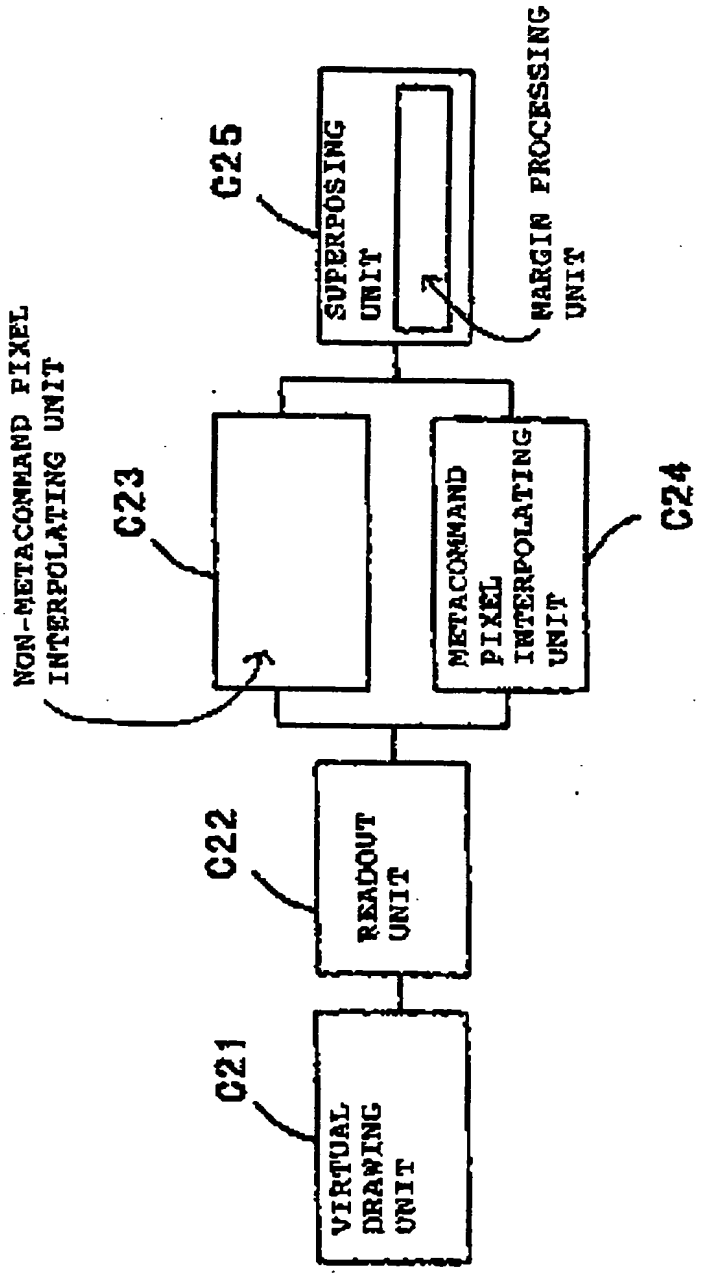
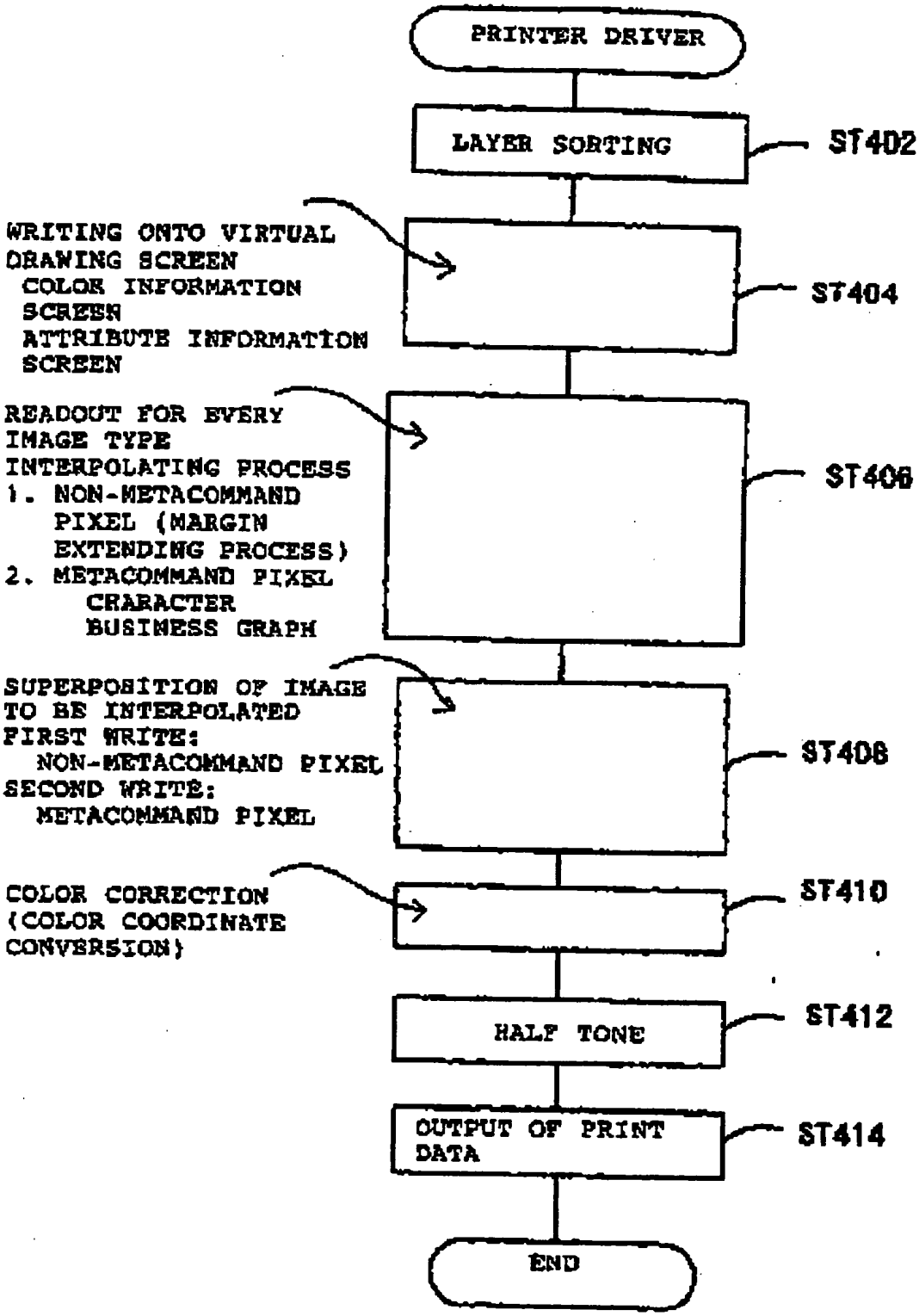

C21
VIRTUAL DRAWING UNIT
C22
READOUT UNIT
C23
NON-METACOMMAND PIXEL INTERPOLATING UNIT
C24
METACOMMAND PIXEL INTERPOLATING UNIT
C25
SUPERPOSING UNIT
MARGIN PROCESSING UNIT

Fig. 26



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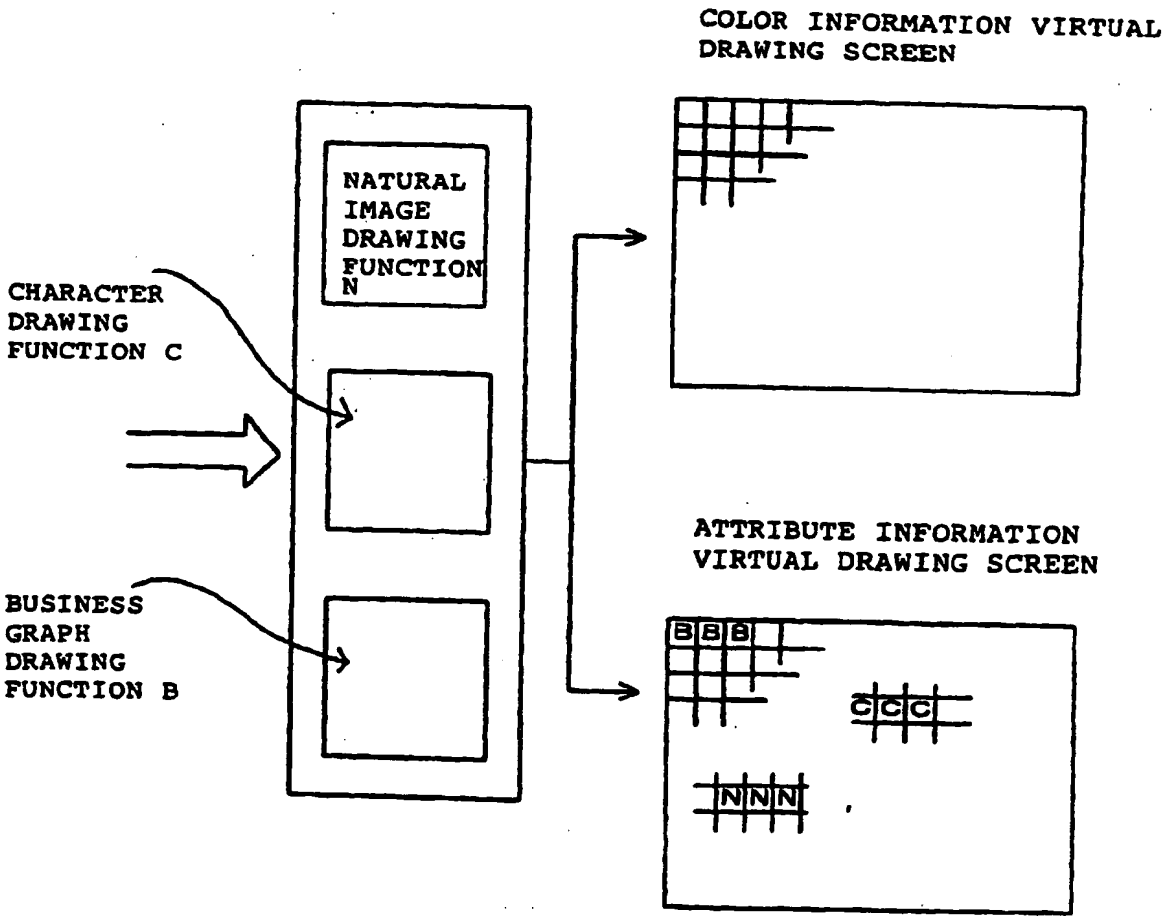


Fig. 5

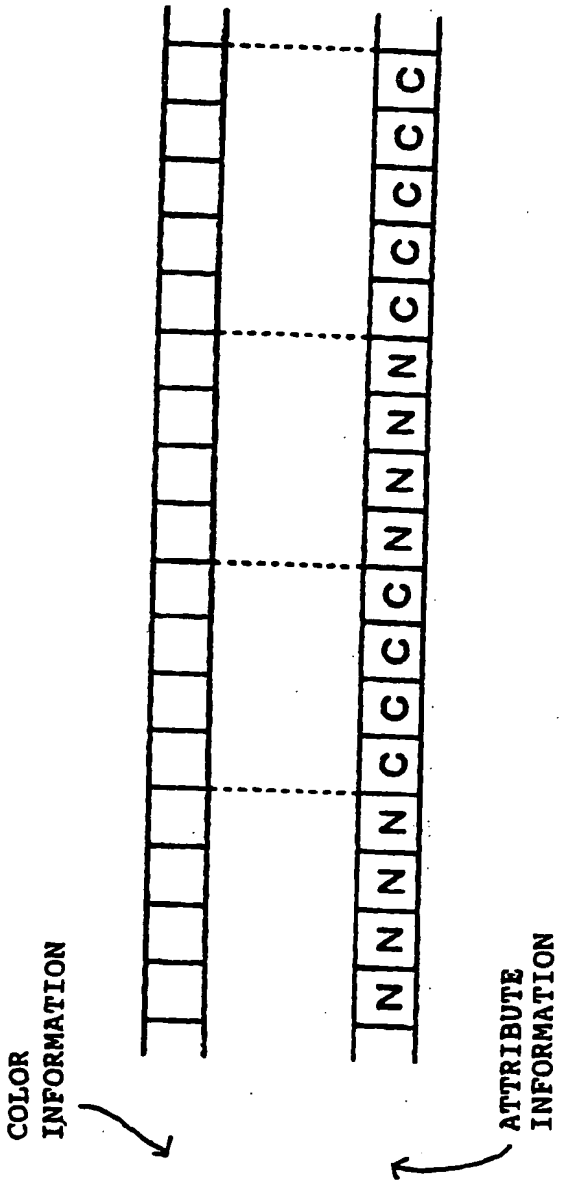


Fig. 6A

Fig. 6B

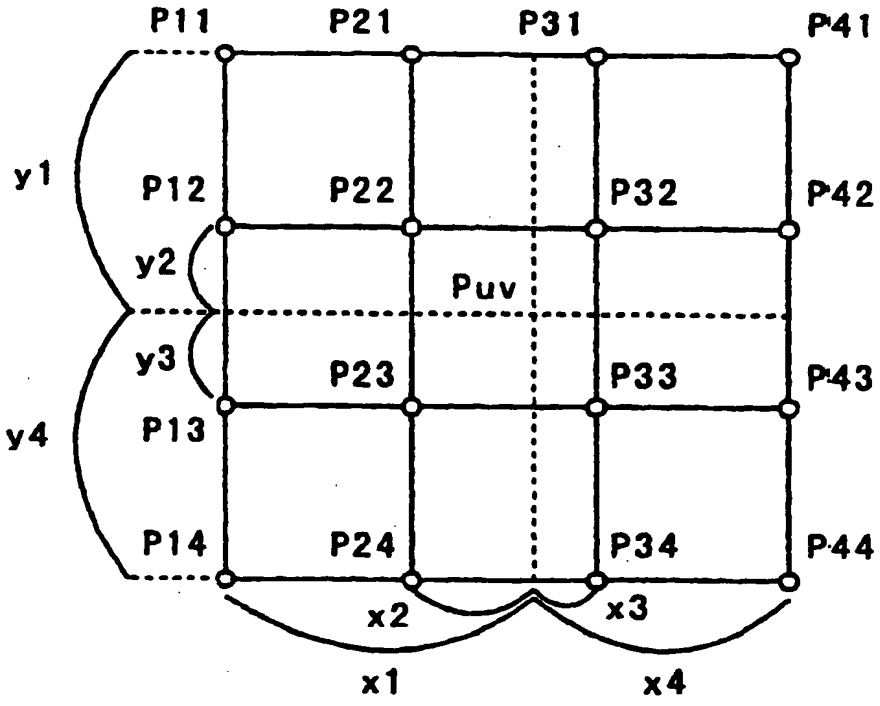


Fig. 7

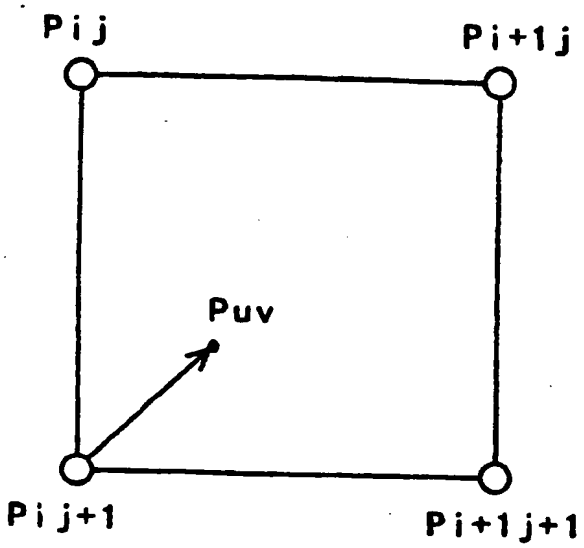


Fig. 8

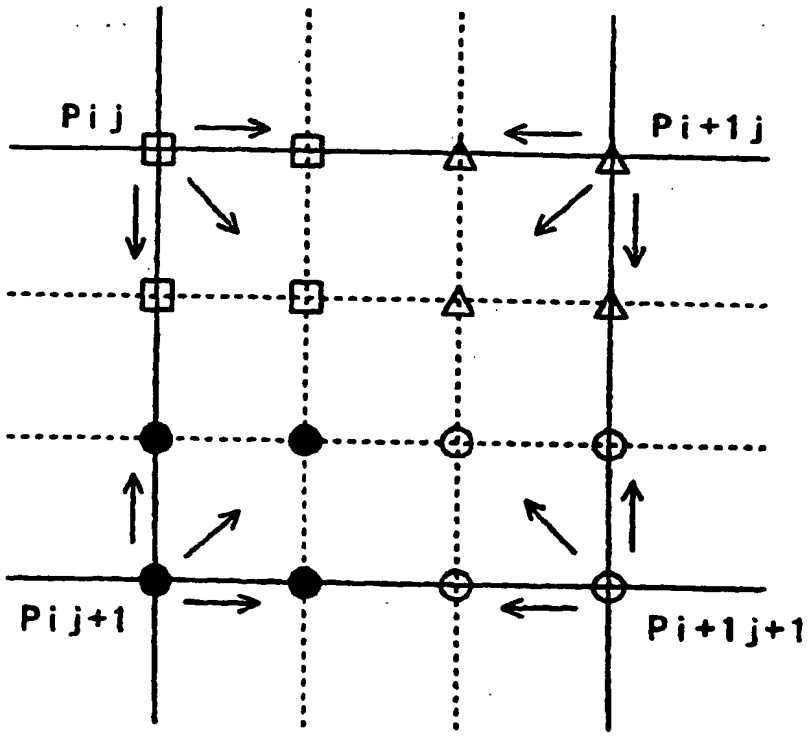
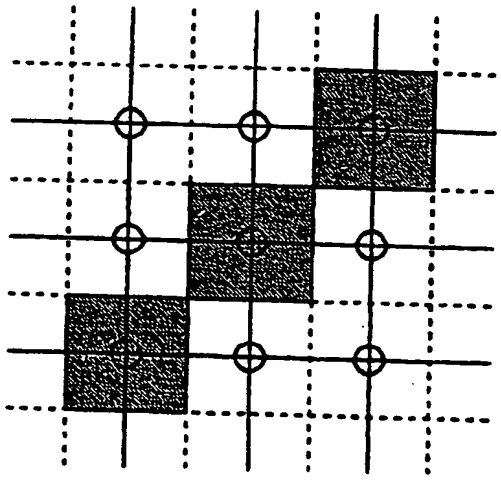
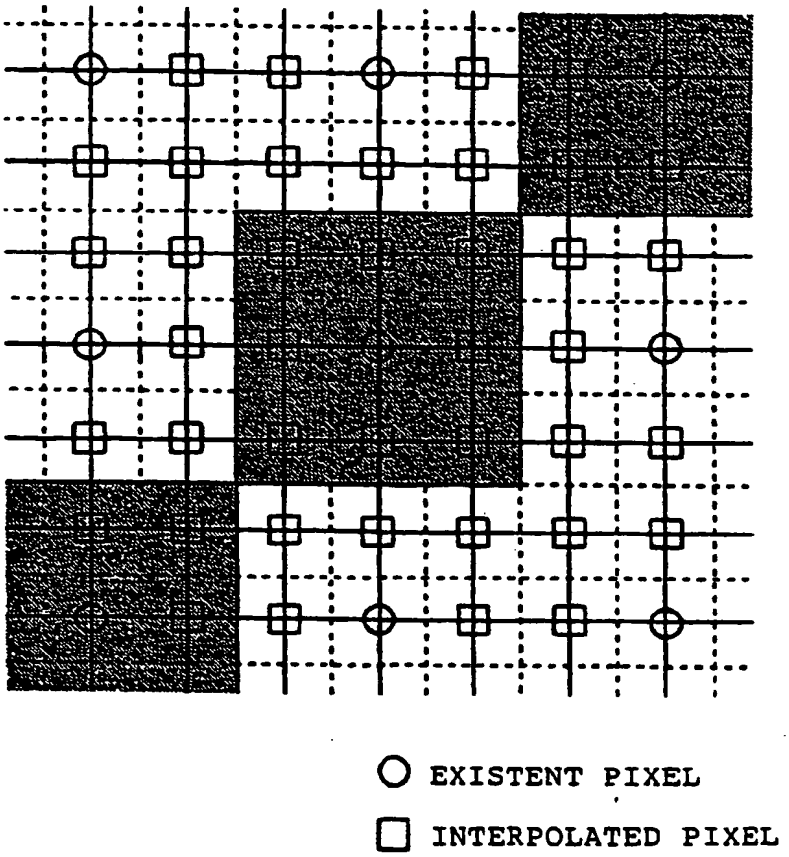


Fig. 9



○ EXISTENT PIXEL

Fig. 10



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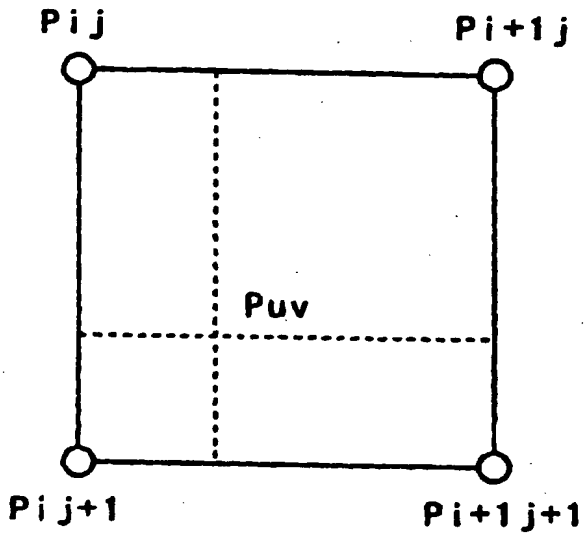

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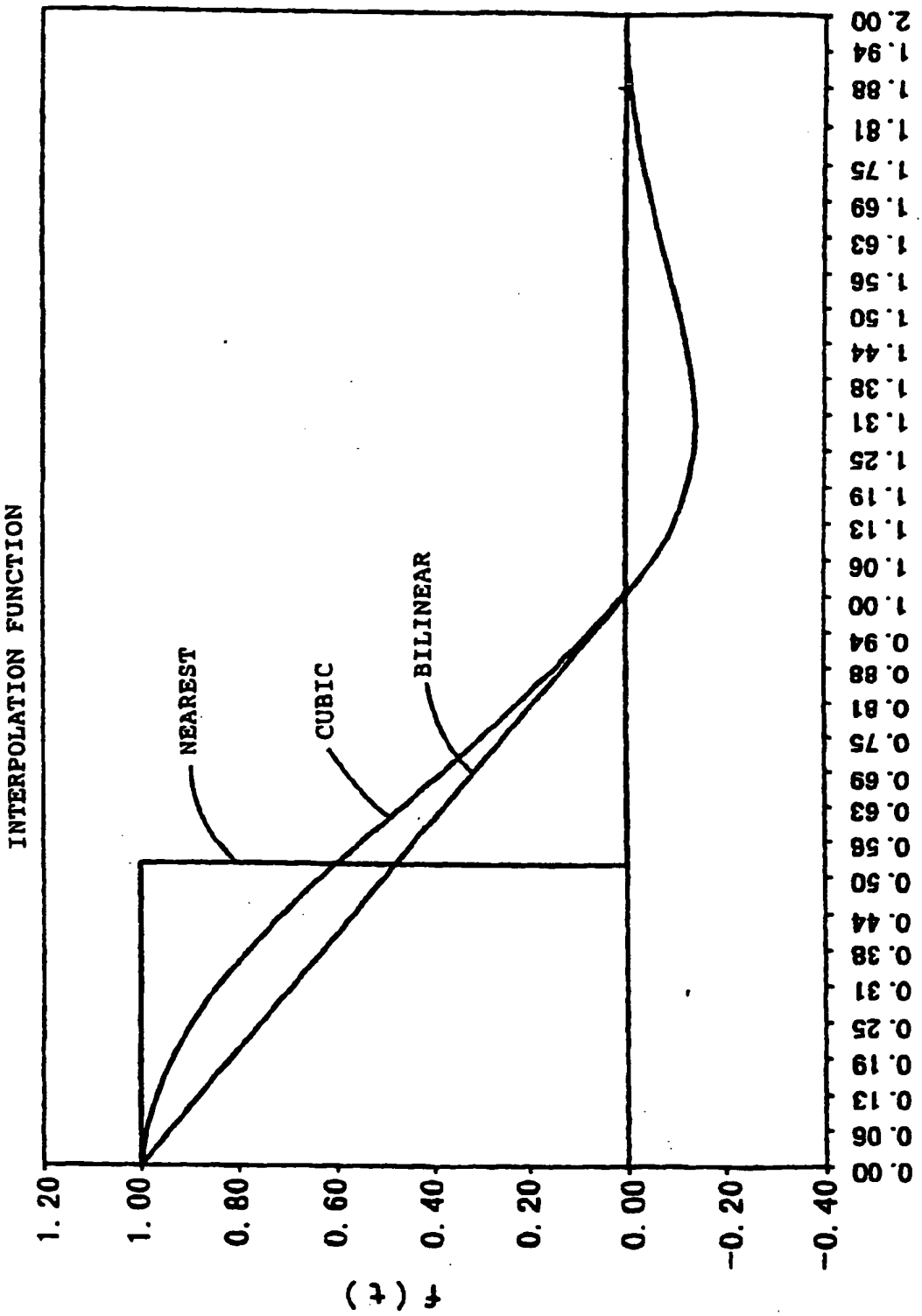


Fig. 13

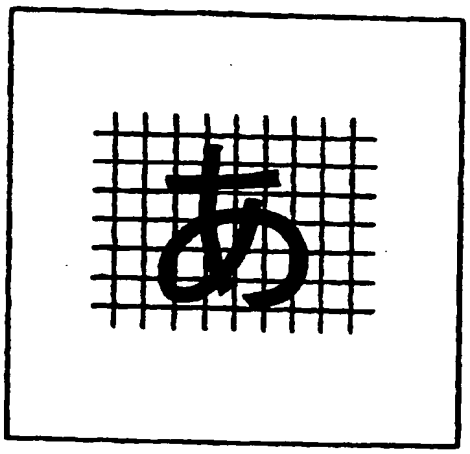


Fig. 14

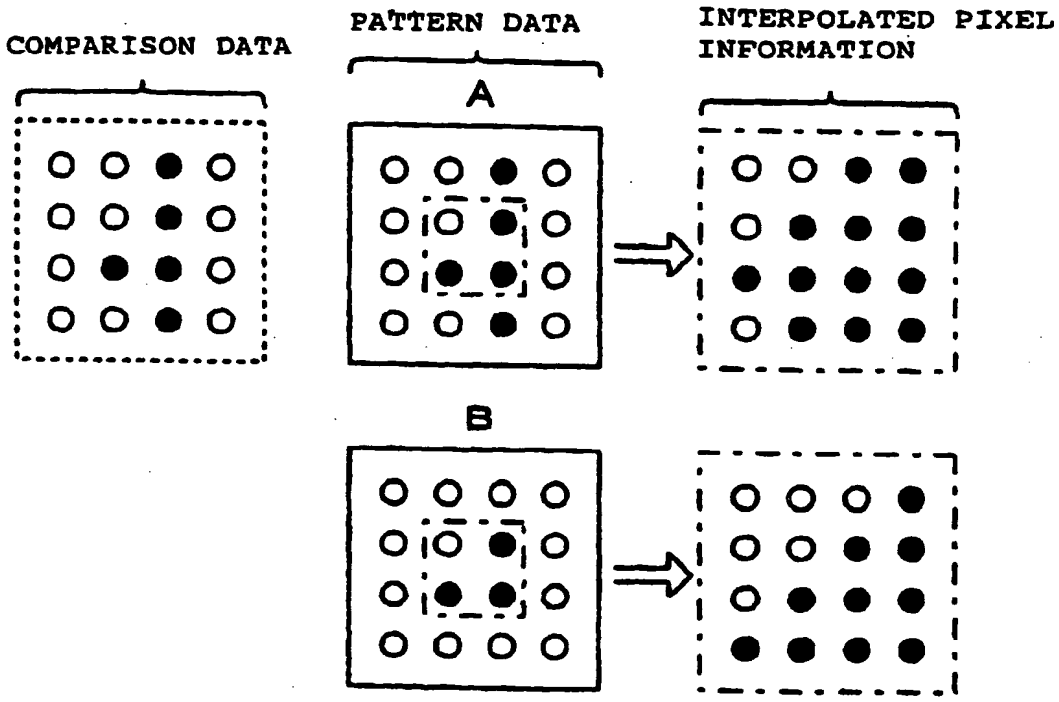


Fig. 15

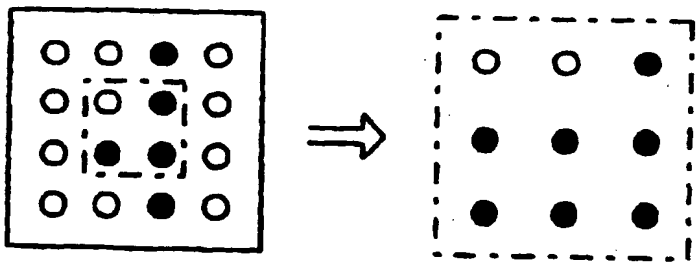


Fig. 16

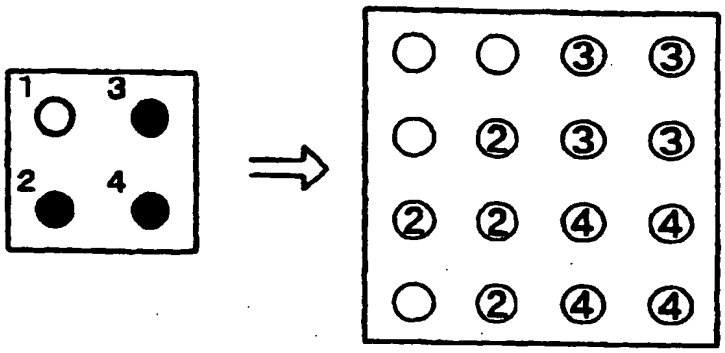


Fig. 17

Fig. 18A

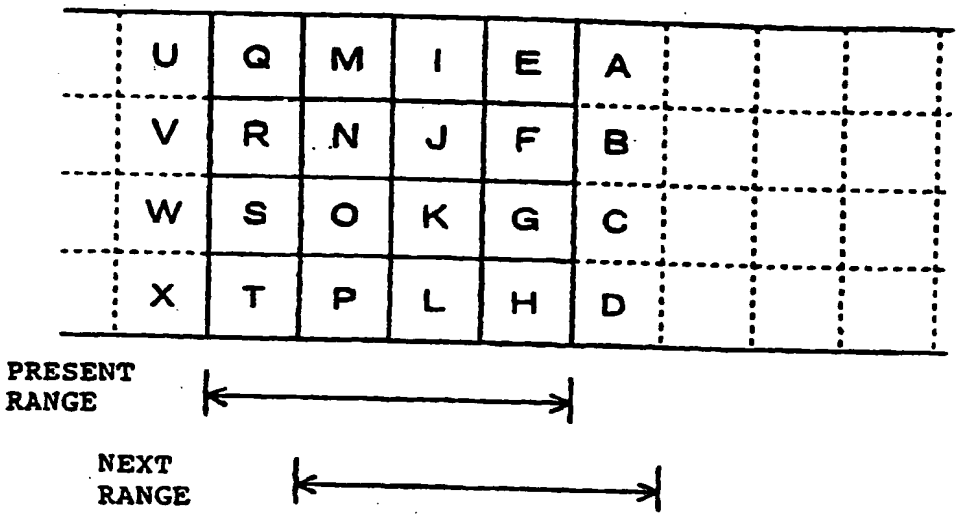


Fig. 18B

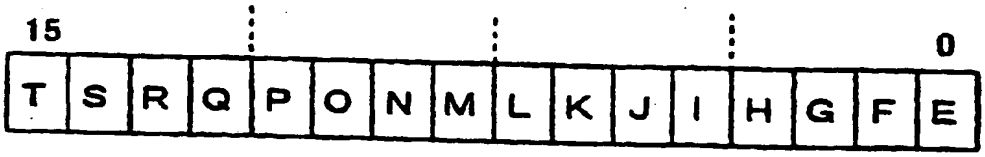
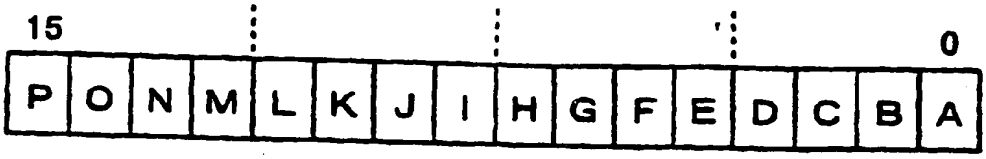


Fig. 18C



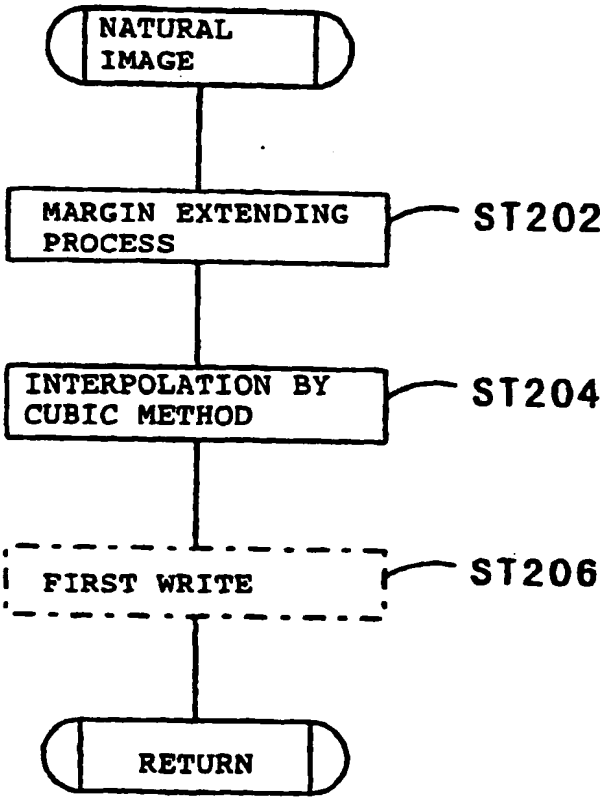


Fig. 19

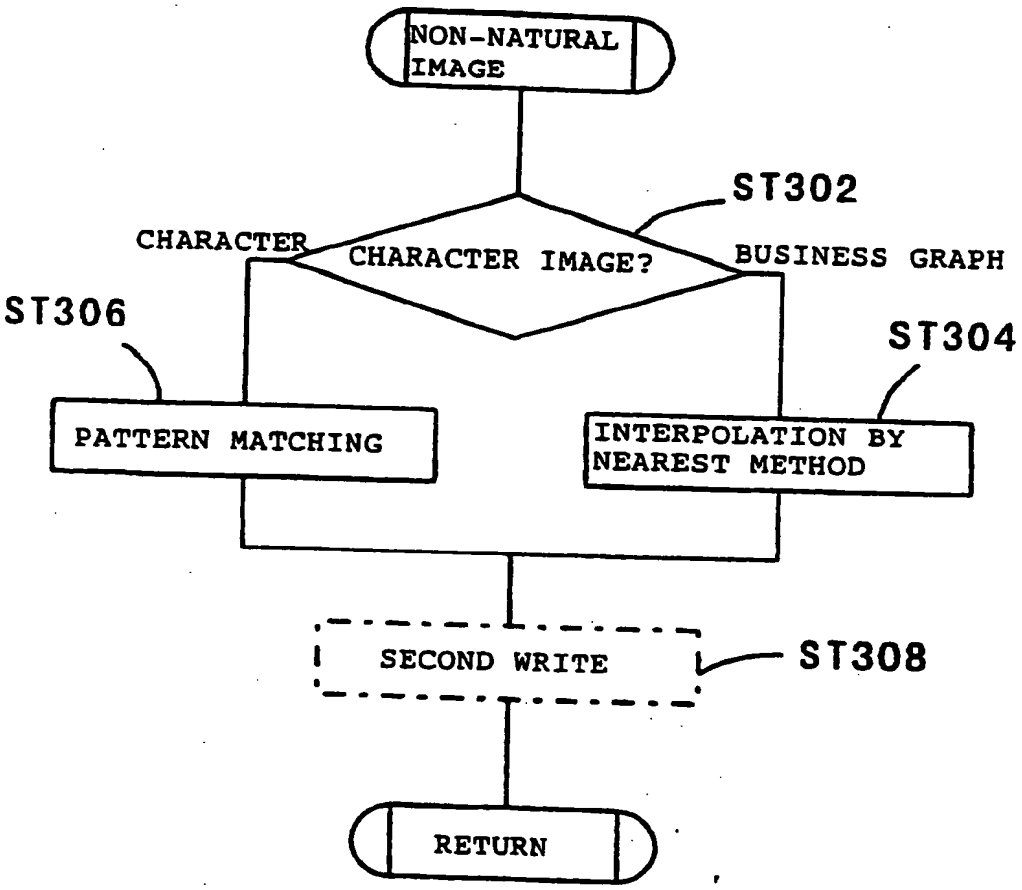

NON-NATURAL IMAGE
ST302
CHARACTER
CHARACTER IMAGE?
BUSINESS GRAPH
ST306
ST304
PATTERN MATCHING
INTERPOLATION BY NEAREST METHOD
SECOND WRITE
ST308
RETURN

Fig. 20

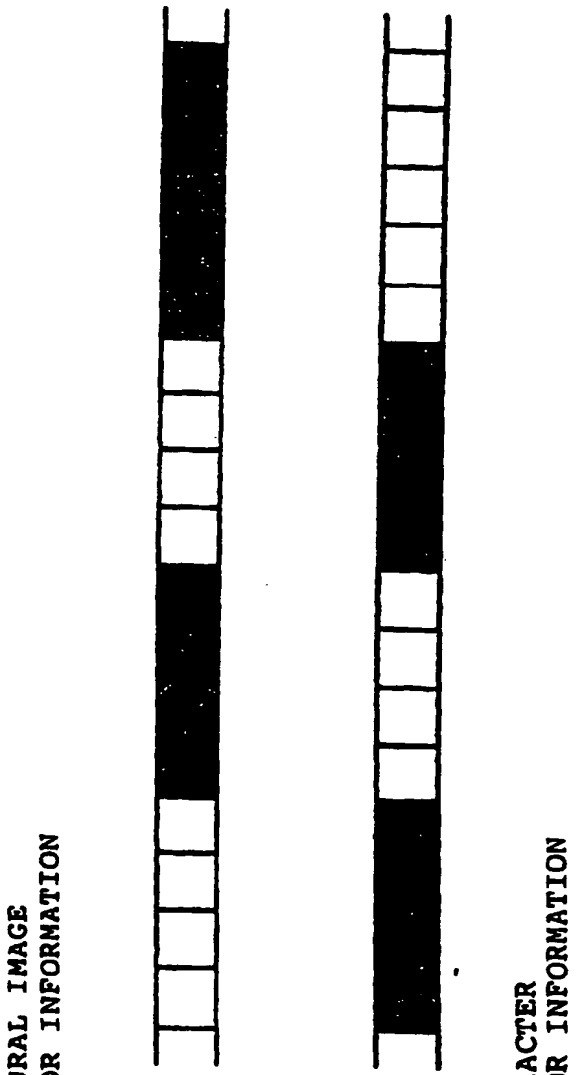


Fig. 21A

Fig. 21B

NATURAL IMAGE
COLOR INFORMATION
INTERPOLATING PROCESS
BUFFER

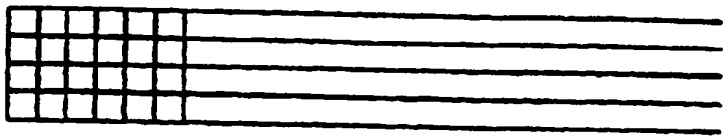


Fig. 22A

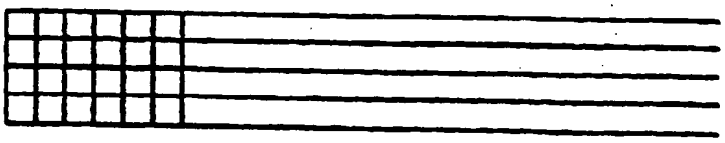
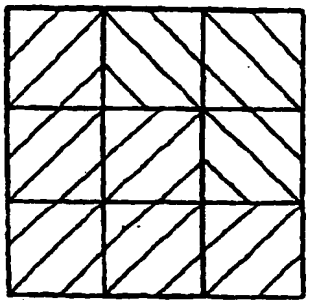


Fig. 22B

CHARACTER
COLOR INFORMATION
INTERPOLATING PROCESS
BUFFER

Fig. 23A

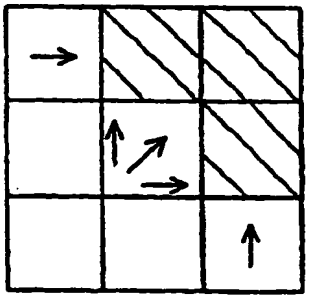
CO-EXISTENT



=

Fig. 23B

NATURAL IMAGE



+

Fig. 23D

NON-NATURAL IMAGE

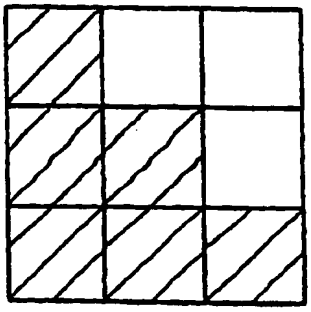


Fig. 23C

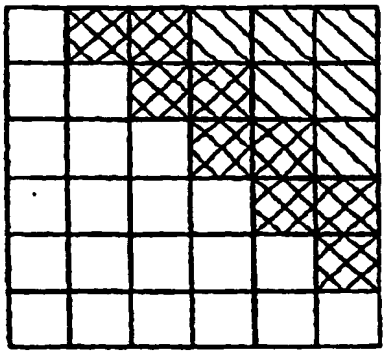


Fig. 23E

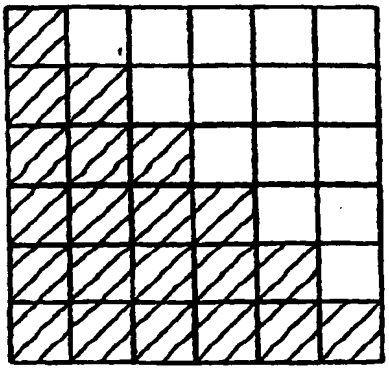
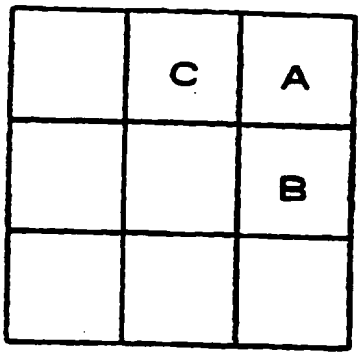
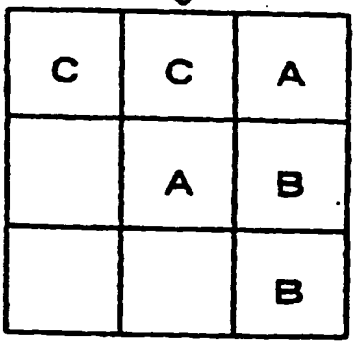


Fig. 24A



MARGINAL EXTENSION

Fig. 24B



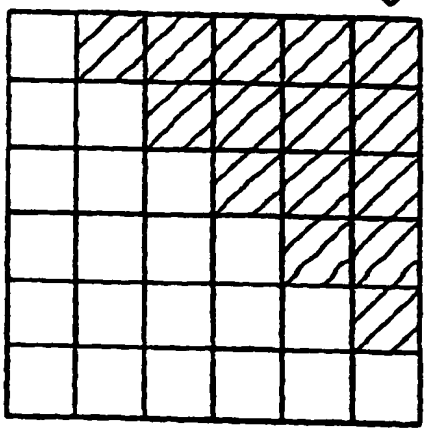


Fig. 24C

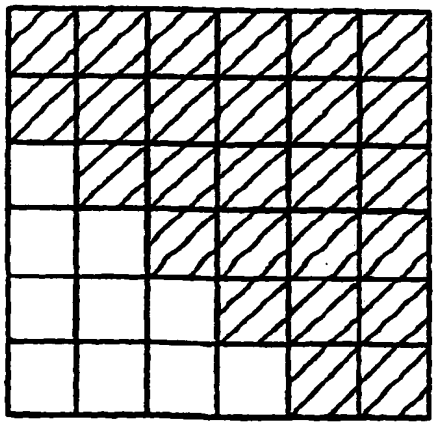


Fig. 24D

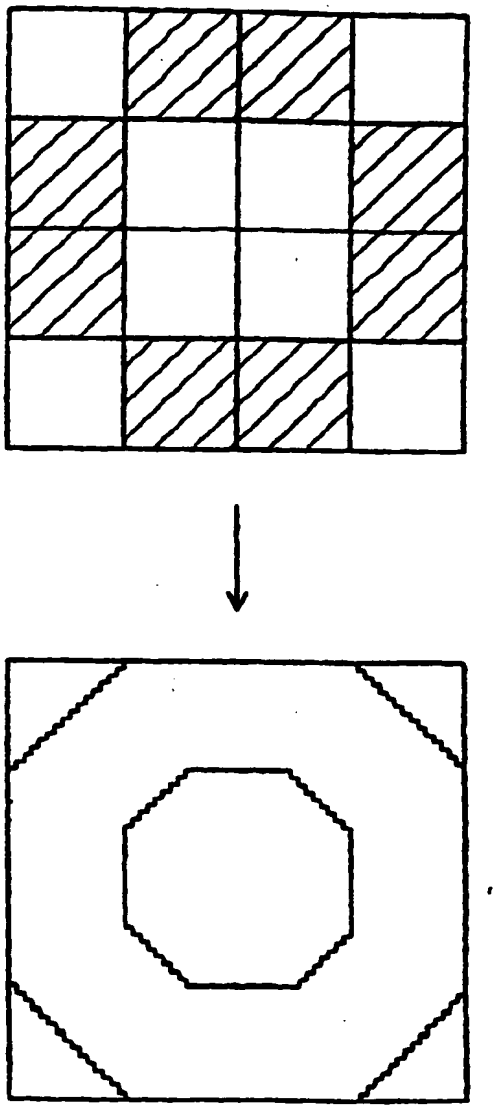


Fig. 25

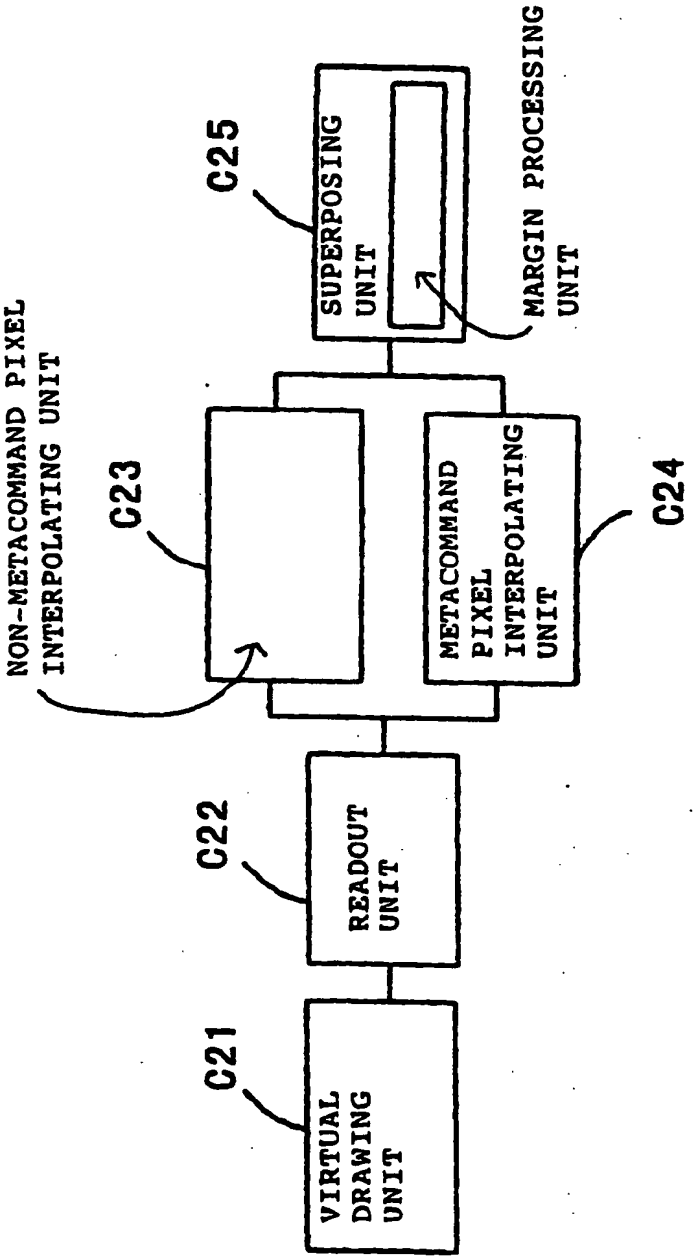


Fig. 26

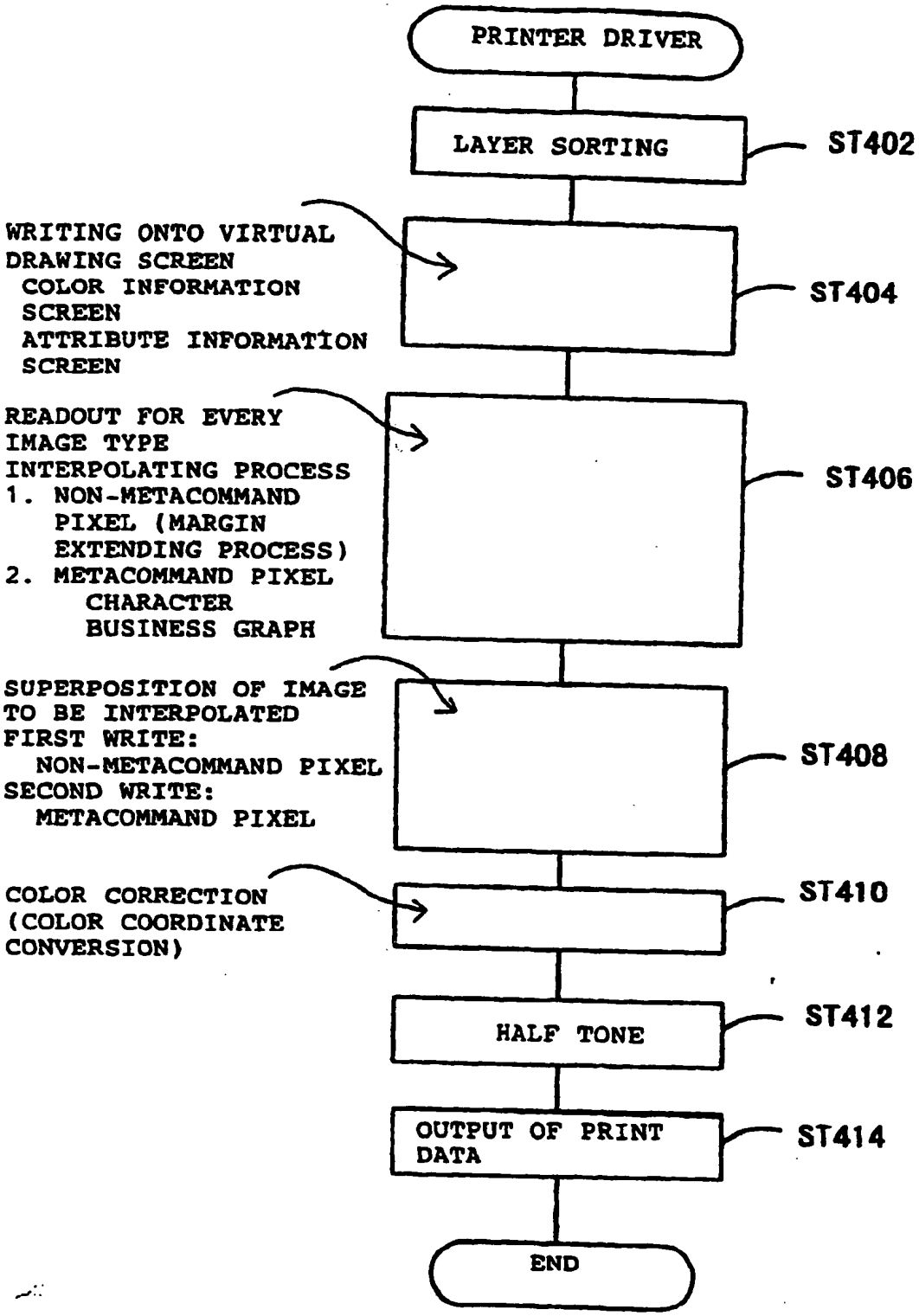


Fig. 27

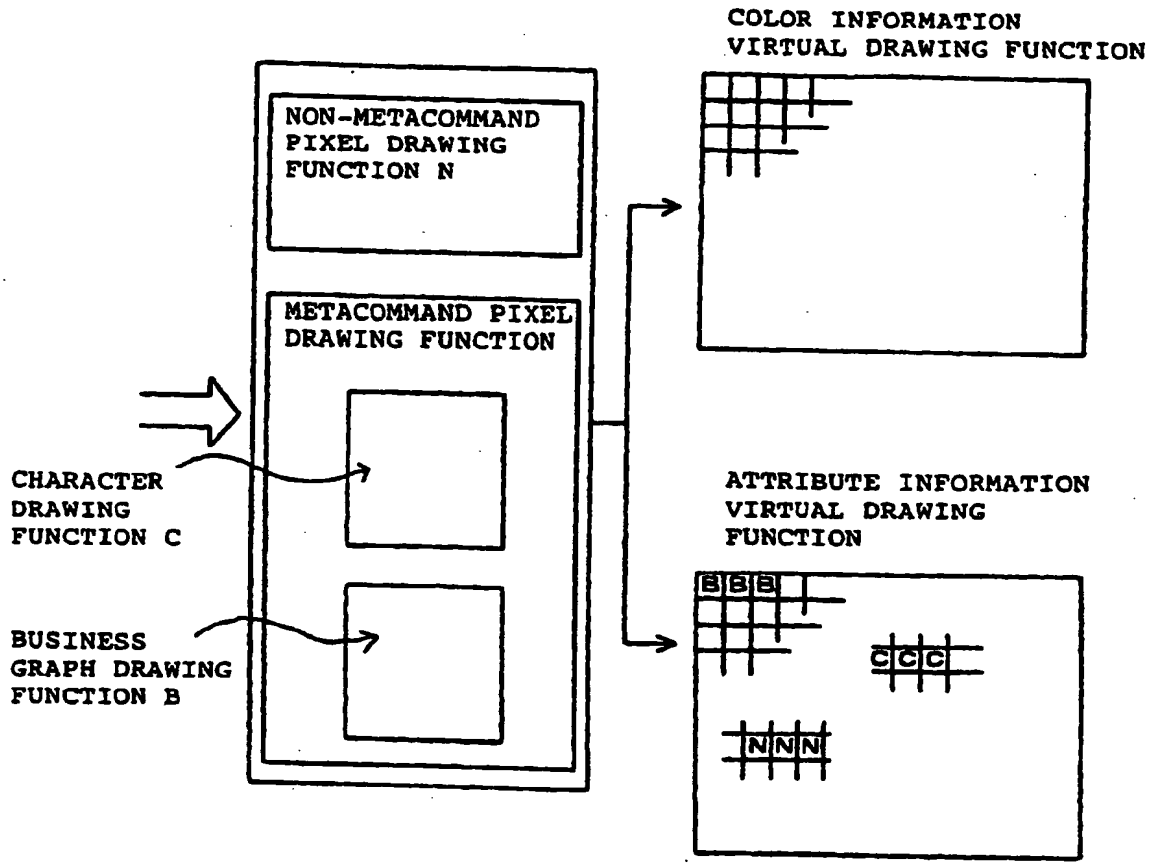

COLOR INFORMATION
VIRTUAL DRAWING FUNCTION
NON-METACOMMAND
PIXEL DRAWING
FUNCTION N
METACOMMAND PIXEL
DRAWING FUNCTION
CHARACTER
DRAWING
FUNCTION C
BUSINESS
GRAPH DRAWING
FUNCTION B
ATTRIBUTE INFORMATION
VIRTUAL DRAWING
FUNCTION
B B B
C C C
N N N

Fig. 28

Fig. 29A

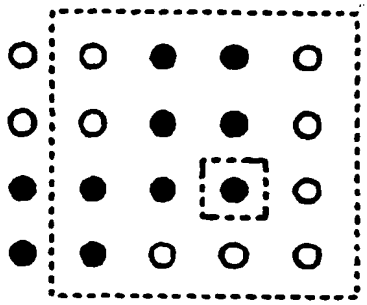


Fig. 29B

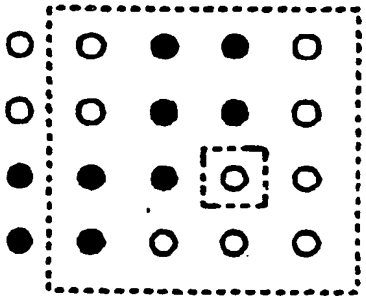


Fig. 29C

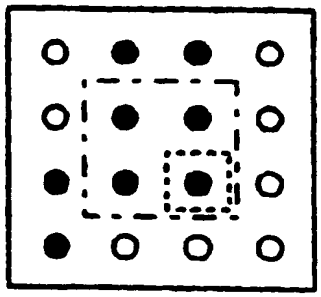
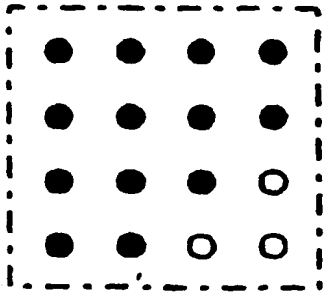


Fig. 29D



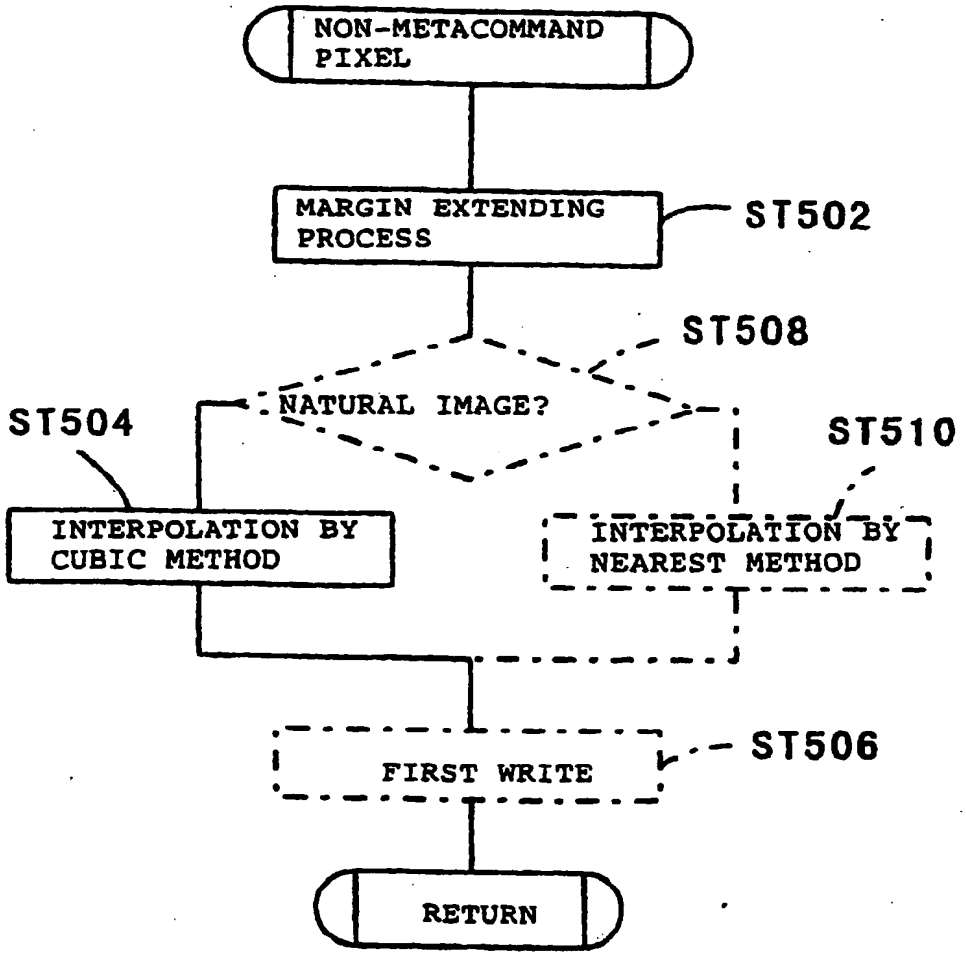


Fig. 30

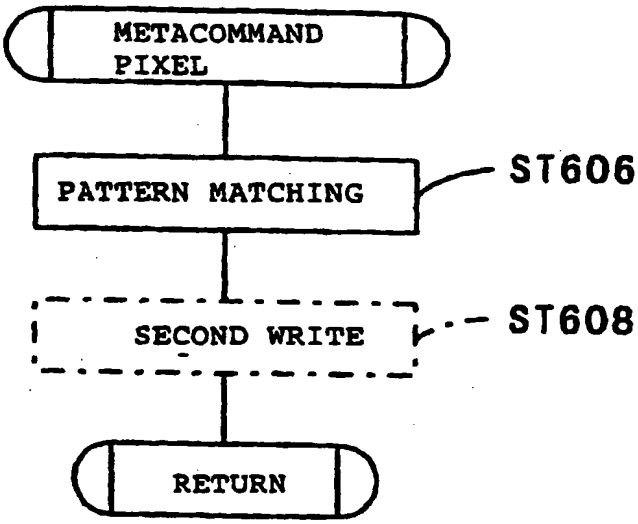


Fig. 31

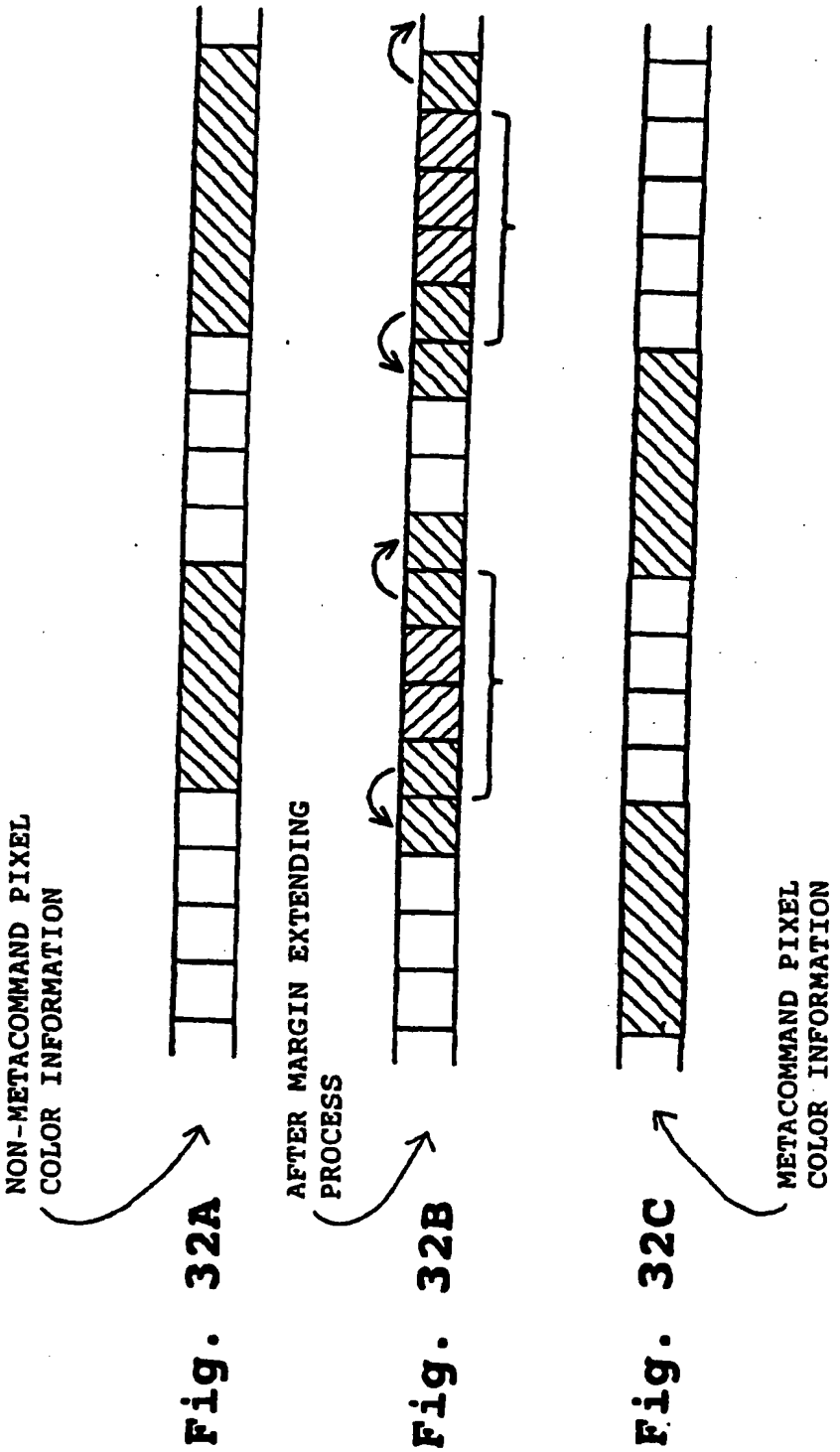


Fig. 32A

Fig. 32B

Fig. 32C

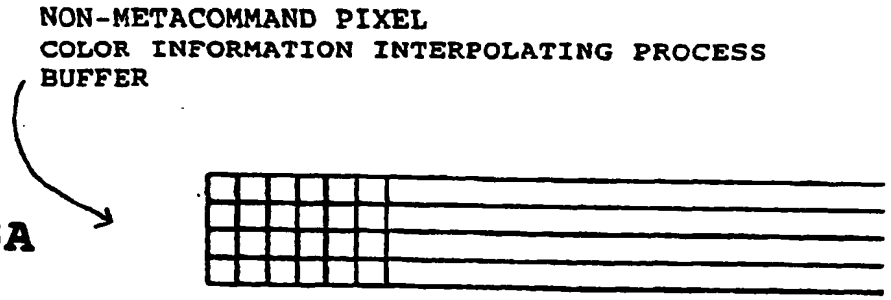


Fig. 33A

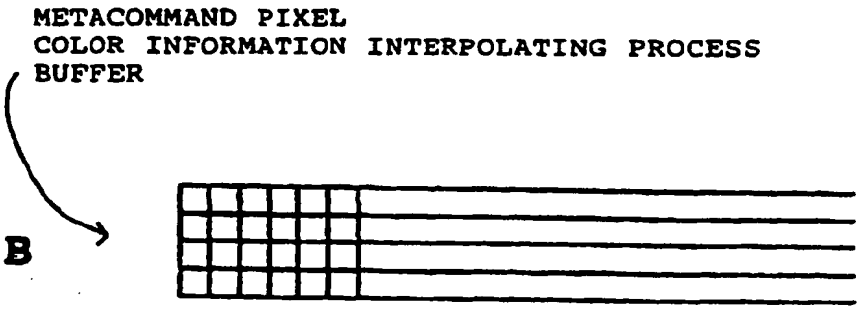


Fig. 33B

Fig. 34A

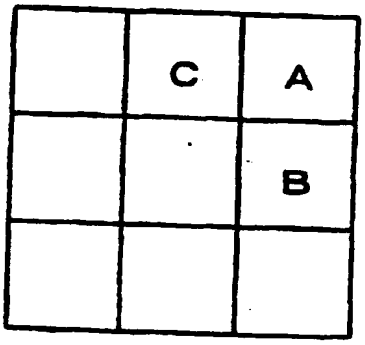
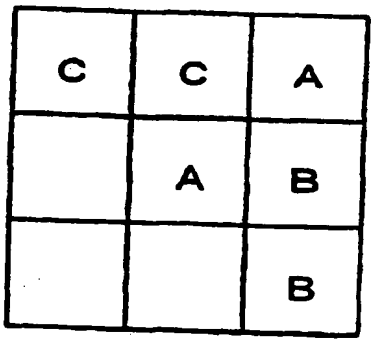
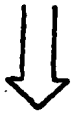


Fig. 34B



MARGINAL EXTENSION



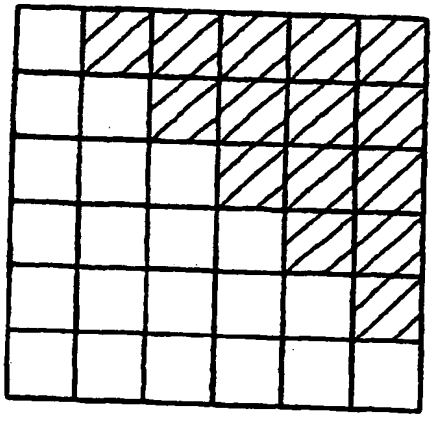


Fig. 34C

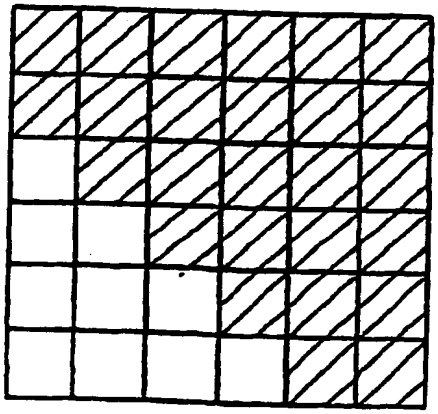


Fig. 34D

[0135] Note a dot surrounded by two-dot chain line. This dot is not considered to be particularly necessary. The other part is considered to show a line with 2-dot width. It is difficult to suppose the necessity that a projecting dot is affixed at the corner. In other words, it is proper to determine that the dot should not be affixed as shown in Fig. 29B. This determination cannot absolutely be made when the region becomes smaller. However, when sixteen pixels are compared with the pattern data as in the embodiment, such determination can be made.

[0136] On the premise as described above, regarding the pattern data containing the dot as shown in Fig. 29C, interpolating pixel information is caused to correspond to the image data. When the pixel as noise produced when the metacommand pixel is translated and drawn is processed through the pattern matching, the same effect is achieved as if the noise pixel is found and deleted in a conversion process and an interpolating pixel is generated so as to correspond to the original metacommand pixel.

[0137] It is obvious that the above-described dot deleting manner can be applied generally to the metacommand. Accordingly, when a dot considered to be noise is generated in the square range of sixteen pixels, interpolating pixel information in which the dot has been deleted is caused to correspond to the pattern data. However, the character has a special characteristic that a large number of drawing commands are applied to a small region, and accordingly, a noise dot tends to be easily generated. As a result, the noise can easily be specified.

[0138] On the premise that the above-described interpolating process is executable, the image is read out for every type and the interpolating process is carried out at step ST406. The image is roughly divided into a non-metacommand pixel and a metacommand pixel. The interpolating process by the cubic method or the nearest method is carried out for the former as shown in Fig. 30. The interpolating process by the pattern matching is carried out for the latter as shown in Fig. 31. Figs. 32A and 32B show a case where image data is read out by one line for every type of image. The pixels are sorted out while it is determined whether each pixel on the color information virtual drawing screen is a non-metacommand pixel (N) or a metacommand pixel (C or B) on the basis of attribute information virtual drawing screen. Pixel information previously initialized as background pixels is applied when sorted.

[0139] Only the horizontal arrangement of the pixels is insufficient for execution of the interpolating process, and information about pixels in the vertical direction is also necessary. Accordingly, four lines of pixels are actually read out to be stored on the work area and the interpolating process is then carried out as shown in Figs. 33A and 33B. Four lines are read out since square sixteen pixels (4×4) are a processing unit in the cubic method or the pattern matching. The number of lines may be increased or decreased as occasion demands.

[0140] In the interpolating process by the above-described pattern matching, a dot affixed as a metacommand pixel is sometimes deleted. Since this dot is a noise dot, the metacommand pixel recovers its original contour by deletion of the dot. However, a process for compensating the dot to be deleted by another pixel. Accordingly, in a case where a dot is deleted when different types of pixels are adjacent to each other, a gap may be produced between the pixels.

[0141] In such a case, a region is previously expanded with respect to the adjacent pixels. Even in a case where a background pixel is generated in the margin when the interpolating process is carried out for the other image, the gap is prevented from being exposed since a pixel in the adjacent image region is generated in the foundation. Accordingly, a margin extending process is carried out for the non-metacommand pixel at step ST502. In the margin extending process, the margin of the pixel is previously extended in the peripheral edge thereof. In Figs. 32A to 32C, when the non-metacommand pixel is read out, one pixel is copied outside a pixel adjacent to the background pixel, whereby the margin extending process is carried out.

[0142] Figs. 34A to 34D show a countermeasure in the interpolating process carried out after the above-described margin extension. In Fig. 34A, three (A to C) of nine pixels contain pixel information and the other six pixels are background pixels. One pixel adjacent to the margin is copied outside the margin, so that the margin is extended, as shown in Fig. 34B. When the margin is not extended, the result of the interpolating process is shown in Fig. 34C. When the interpolating process is carried out after the margin extension, the original margin is outwardly spread as shown in Fig. 34D. Consequently, the foundation is formed for the adjacent pixel. Although the margin is extended outward by one pixel in the example, the margin may be extended by the number of pixels according to the number of dots to be deleted by the pattern matching with respect to the adjacent metacommand pixels.

[0143] At step ST502, the margin extending process is carried out in the above-described sense. The interpolating process by the cubic method is carried out at step ST504, that is, metacommand pixels are read out and the interpolating process most suitable for the natural image is carried out.

[0144] In Fig. 30, chain line denotes a determining process as to whether the image is a natural image and the interpolating process by the nearest method. As described above, the embodiment shows that a bit-map image is determined to be a metacommand pixel but the image may further be determined whether it is a natural image. Accordingly, the image is written on the virtual region so that types of metacommand pixels are recognizable. At step ST508, the determination is made as to whether the image is a natural image. When the image is a natural image, the interpolating process by the cubic method is carried out at step ST504 as described above. When the image is not a natural image, the interpolating process by the nearest method is carried out at step ST510.

[0145] Regarding metacommand pixels, the interpolating process by the pattern matching is carried out at step

ST606. As a result, the dot as noise is deleted concerning the character such that a character with fine lines is obtained. Concerning the business graph, a smoothed image with no unnatural dot is obtained. Thus, a most suitable interpolating process can be carried out.

[0146] Regarding the metacommand pixels, dots sometimes lack in the interpolating process. As a countermeasure, a margin extending process is carried out for the adjacent non-metacommand pixel, and a metacommand pixel is overwritten. More specifically, the image is firstly written at step ST506 after the interpolating process concerning the non-metacommand pixel. Regarding the metacommand pixel, the image is secondly written at step ST608 after the interpolating process. Steps ST506 and ST608 in Figs. 30 and 31 respectively are shown by chain line. These processes actually correspond to the interpolated pixel superposing process at step ST408 in Fig. 27.

[0147] Describing significance of the first writing step ST506 and the following writing step ST408, the non-metacommand pixel and the metacommand pixel are separated from each other and these pixels are interpolated in separate work areas. Thereafter, when the pixels are combined together, the non-metacommand pixel for which the margin has been extended is firstly written, and the metacommand pixel for which the interpolating process has been carried out in correspondence to the original metacommand pixel is secondly written. In this case, when the firstly written pixel and the second written pixel are not overlapped, the firstly written pixel is maintained. When the pixels are overlapped, the secondly written pixel is maintained. Accordingly, the foundation is not exposed even when the marginal contour of the secondly written pixel is changed at the margin where both pixels are adjacent to each other. Overwriting is unnecessary for background pixels. Pixels to be overwritten are those other than the background pixels.

[0148] The writing order is one mode of a preferential process in the superposing process. A control manner for the writing order in the preferential process is varied on an actual program. Accordingly, the preferential process can only be substantially maintained. The same process may be realized by another technique.

[0149] When the interpolated pixels are superposed, a color correction is carried out for conversion of color coordinates from RGB to CMYK at step ST410. A half tone process is carried out at step ST412 since the color printer 17b has two gradations. Print data is output to the color printer 17b at step ST414.

[0150] The foregoing description relates to the printer driver 12c and can also be applied to the display driver 12b.

[0151] The interpolating process is carried out in consideration of the original metacommand with respect to the pixel generated in correspondence to the metacommand, so that the processed image itself can be improved. However, the marginal region does not correspond with the adjacent pixel. In order that this unanturalness may be solved, the margin is extended concerning the non-metacommand pixel and the interpolating process is then carried out. Further, the metacommand pixel has preference in the portion where the metacommand and non-metacommand pixels are superposed. Almost all the extended margin becomes the foundation of the adjacent region to thereby be concealed. However, generation of the background pixel can be prevented when the marginal contour is changed.

INDUSTRIAL APPLICABILITY OF THE INVENTION

[0152] According to the invention of claim 1, an interpolating process corresponding to every type of image data is carried out. Consequently, the image data interpolating apparatus can provide a fine interpolated image even when different type of image data are co-existent.

[0153] According to the invention of claim 2, writing onto the virtual region can be accomplished easily.

[0154] According to the invention of claim 3, adjustment is performed according to the characteristic of the interpolating process in the superposition since the processing near the margin tends to differ depending upon the interpolating process. Consequently, a fine marginal configuration can be obtained.

[0155] According to the invention of claim 4, the foundation for the marginal portion can be generated since the margin is extended. Consequently, influences due to lack of pixels in the adjacent image data can be eliminated.

[0156] According to the invention of claim 5, when information outside the margin is drawn in, a pixel about which information is absent. This results in the same influences as those due to lack of pixels. The influences can be prevented by previous extension.

[0157] According to the invention of claim 6, no gap is produced near the marginal portion even when such a processing as to positively smooth the marginal configuration in the image interpolating process for the metacommand. Consequently, desired results of interpolation can be achieved.

[0158] According to the invention of claim 7, a processing for expanding the peripheral region can easily be performed.

[0159] According to the invention of claim 8, the processing can be simplified since the adjustment is performed by the sequence.

[0160] According to the invention of each of claims 9 to 16, the image data interpolating method achieving the same effects as described above can be provided.

[0161] According to the invention of each of claims 17 to 24, the medium on which the image data interpolating program achieving the same effects as those described above is recorded can be provided.

Claims

1. An image data interpolating apparatus which obtains image data containing attribute information capable of distinguishing a type of image for every pixel and enlarges the image data by an interpolating process and which comprises a readout unit (C12) which reads out the image data, characterized by:

   an interpolating unit (C13) which distinguishes a plurality of image types of the pixels based on the attribute information and applies one of a plurality of interpolating processes differing for every one of the image types to each of the pixels; and
   a synthesizing unit (C14) which synthesizes the pixels interpolated by the different interpolating processes.

2. The image data interpolating apparatus according to claim 1, further characterized by a virtual drawing unit (C11) which inputs the plurality of types of image data having different image types to superpose the image data in a predetermined order and renders the image types distinguishable, thereby performing a drawing operation in a virtual region, and in that the readout unit (C12) reads out the image data from the virtual region.

3. The image data interpolating apparatus according to claim 1 or 2, characterized in that the synthesizing unit (C14) includes a margin processing unit which adjusts superposition of margins of the image data after interpolation of the pixels.

4. The image data interpolating apparatus according to claim 3, characterized in that when the readout unit (C12) reads out the image data, the margin processing unit causes the readout unit (C12) to read out the image data with a margin enlarged, thereby superposing the image data on the image data interpolated by the interpolating unit (C13) on the basis of the image data with the enlarged margin.

5. The image data interpolating apparatus according to claim 4, characterized in that the margin processing unit enlarges the margin of the image data with respect to an interpolating process in which information outside the margin is drawn in.

6. The image data interpolating apparatus according to any one of claims 1 to 5, characterized in that said plurality of types of image data having different image types include image data corresponding to a metacommand and other image data, and further characterized by:

   a non-metacommand pixel interpolating unit (C23) which enlarges a marginal region when the pixel corresponding to the image data other than the metacommand and performing an interpolating process so that a predetermined interpolation scale factor is obtained; and
   a metacommand pixel interpolating unit (C24) which generates an interpolated pixel so that the interpolated pixel corresponds to the original metacommand when reading out the pixel corresponding to the metacommand and performing an interpolating process so that the interpolating scale factor is obtained,
   and characterized in that the synthesizing unit (C25) synthesizes a result of interpolation by the non-metacommand pixel interpolating unit and a result of interpolation by the metacommand pixel interpolating unit, the synthesizing unit (C25) preferring the result of interpolation by the metacommand pixel interpolating unit (C24) with respect to the superposed portion.

7. The image data interpolating apparatus according to claim 6, characterized in that the non-metacommand pixel interpolating unit (C23) uses information about the pixel in the marginal region as information about a pixel outside the marginal region.

8. The image data interpolating apparatus according to any one of claims 1 to 7, characterized in that the synthesizing unit (C25) synthesizes the pixels, superposing pixels in the result of interpolation by the metacommand pixel interpolating unit (C24) other than background pixels on the result of interpolation by the non-metacommand pixel interpolating unit (C23).

9. An image data interpolating method which obtains image data containing attribute information capable of distinguishing a type of image in the unit of pixel and enlarges the image data by an interpolating process and which includes the step of reading out the image data, characterized by the step of distinguishing a plurality of image types of the pixels based on the attribute information, applying one of a plurality of interpolating processes differing for every one of the image types to each one of the pixels, and synthesizing the pixels interpolated by the different

interpolating processes.

10. The image data interpolating method according to claim 9, characterized in that the plurality of types of image data having different image types are input and superposed in a predetermined order in a virtual region with the image types being rendered distinguishable, thereby drawing in a virtual region, and the image data is read out from the virtual region.

11. The image data interpolating method according to claim 9 or 10, characterized in that superposition of margins of the image data after interpolation of the pixels is adjusted.

12. The image data interpolating method according to claim 11, characterized in that when the image data is read out, the image data with a margin enlarged is read out and the image data is superposed on the image data interpolated by the interpolating means on the basis of the image data with the enlarged margin.

13. The image data interpolating method according to claim 12, characterized in that the margin of the image data is enlarged with respect to an interpolating process in which information outside the margin is drawn in.

14. The image data interpolating method according to any one of claims 9 to 13, characterized in that:

said plurality of types of image data having different image types include image data corresponding to a metacommand and other image data;
a marginal region is enlarged when the pixel corresponding to the image data other than the metacommand and an interpolating process is performed so that a predetermined interpolation scale factor is obtained,
an interpolated pixel is generated so that the interpolated pixel corresponds to the original metacommand when the pixel corresponding to the metacommand is read out and an interpolating process is performed so that the interpolating scale factor is obtained, and
a result of interpolation by the non-metacommand pixel interpolating means and a result of interpolation by the metacommand pixel interpolating means are synthesized, the result of interpolation by the metacommand pixel interpolating means being preferred with respect to the superposed portion.

15. The image data interpolating method according to claim 14, characterized in that information about the pixel in the marginal region is used as information about a pixel outside the marginal region.

16. The image data interpolating method according to any one of claims 9 to 15, characterized in that the pixels are synthesized with the result of interpolation by the metacommand pixel interpolating unit (C24) other than background being superposed on the pixels in the result of interpolation by the non-metacommand pixel interpolating unit (C23).

17. A medium on which an image data interpolating program is recorded, the program accomplishing the function of obtaining image data containing attribute information capable of distinguishing a type of image in the unit of pixel and enlarging the image data by an interpolating process, the program accomplishing on a computer the steps of:

reading out image data; and
distinguishing a plurality of image types of the pixels based on the attribute information, applying one of a plurality of interpolating processes differing for every one of the image types to each of the pixels, and synthesizing the pixels interpolated by the different interpolating processes.

18. The medium according to claim 17, characterized in that the plurality of types of image data having different image types are input and superposed in a predetermined order in a virtual region with the image types being rendered distinguishable, thereby drawing in a virtual region, and the image data is read out from the virtual region.

19. The medium according to claim 17 or 18, characterized in that superposition of margins of the image data after interpolation of the pixels is adjusted.

20. The medium according to claim 19, characterized in that when the image data is read out, the image data with a margin enlarged is read out and the image data is superposed on the image data interpolated by the interpolating unit (C13) on the basis of the image data with the enlarged margin.

21. The medium according to claim 20, characterized in that the margin of the image data is enlarged with respect to an interpolating process in which information outside the margin is drawn in.

22. The medium according to any one of claims 17 to 21, characterized in that:

said plurality of types of image data having different image types include image data corresponding to a metacommand and other image data,
a marginal region is enlarged when the pixel corresponding to the image data other than the metacommand and an interpolating process is performed so that a predetermined interpolation scale factor is obtained,
an interpolated pixel is generated so that the interpolated pixel corresponds to the original metacommand when the pixel corresponding to the metacommand is read out and an interpolating process is performed so that the interpolating scale factor is obtained, and
a result of interpolation by the non-metacommand pixel interpolating unit and a result of interpolation by the metacommand picture element interpolating unit are synthesized, the result of interpolation by the metacommand pixel interpolating unit being preferred with respect to the superposed portion.

23. The medium according to claim 22, characterized in that information about the pixel in the marginal region is used as information about a pixel outside the marginal region.

24. The medium according to any one of claims 17 to 23, characterized in that the pixels are synthesized with the result of interpolation by the metacommand pixel interpolating unit (C24) other than background being superposed on the pixels in the result of interpolation by the non-metacommand pixel interpolating unit (C23).

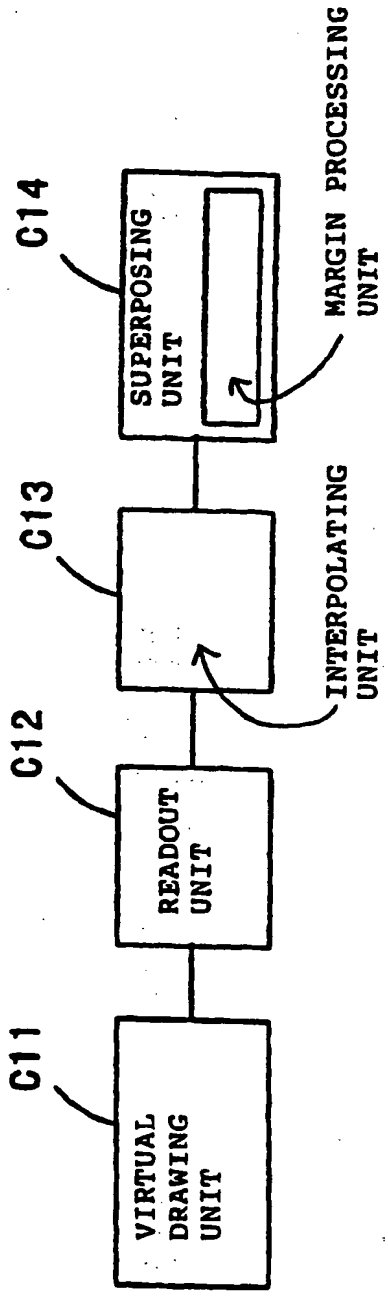


Fig. 1

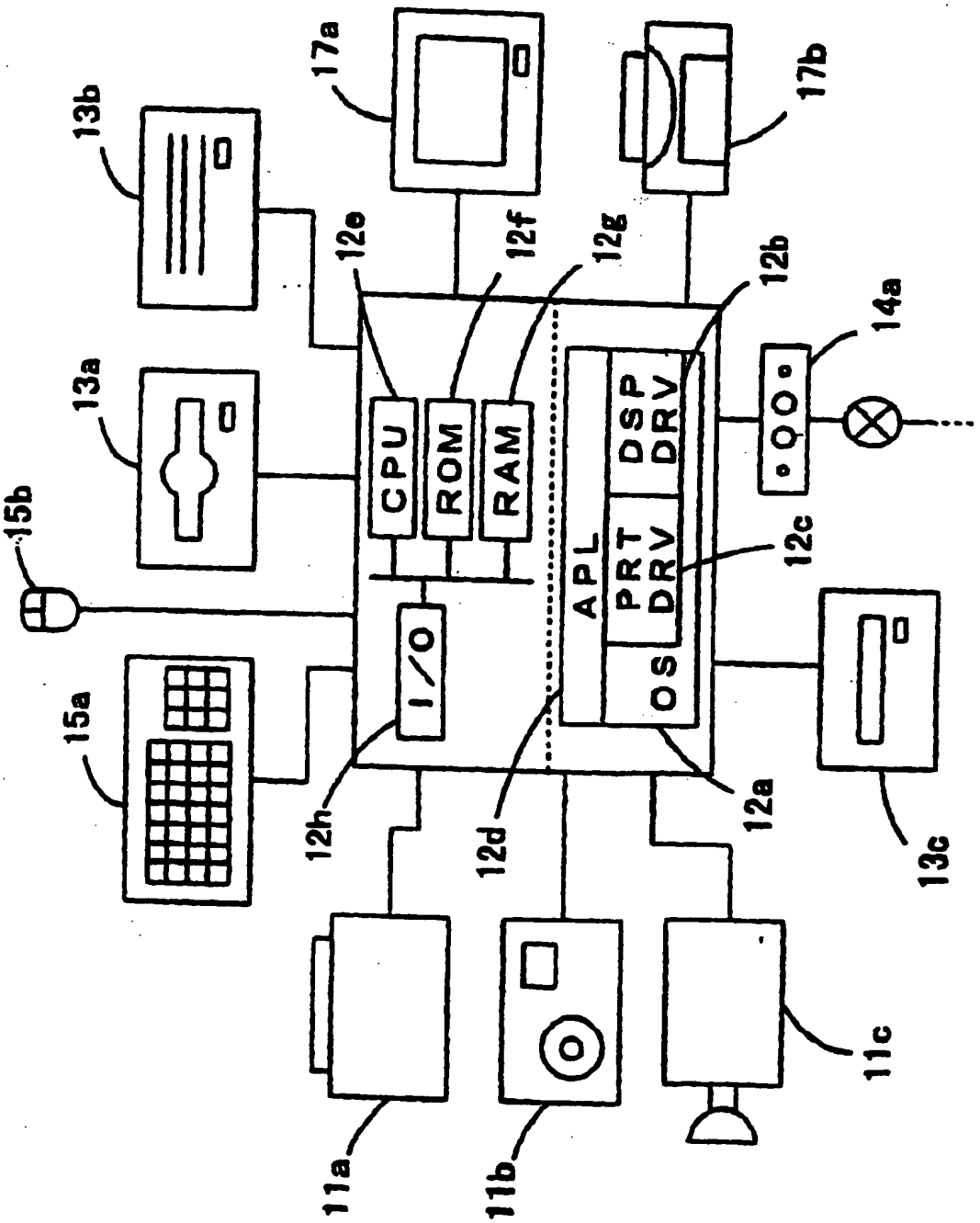

17a
17b
13b
13a
15b
15a
12e
12f
12g
12b
14a
CPU
ROM
RAM
APL
PRT DRV
DSP DRV
OS
I/O
12c
12h
12d
12a
13c
11a
11b
11c

Fig. 2

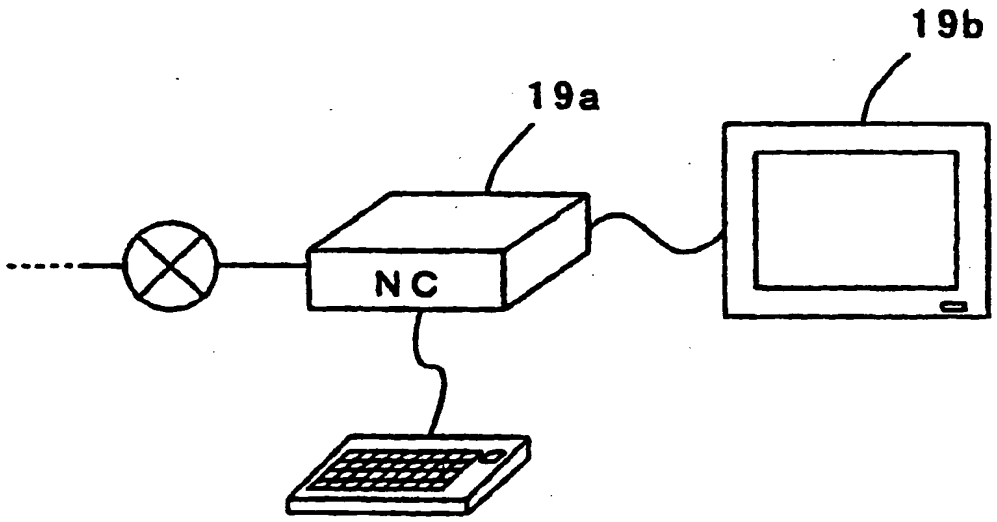


Fig. 3

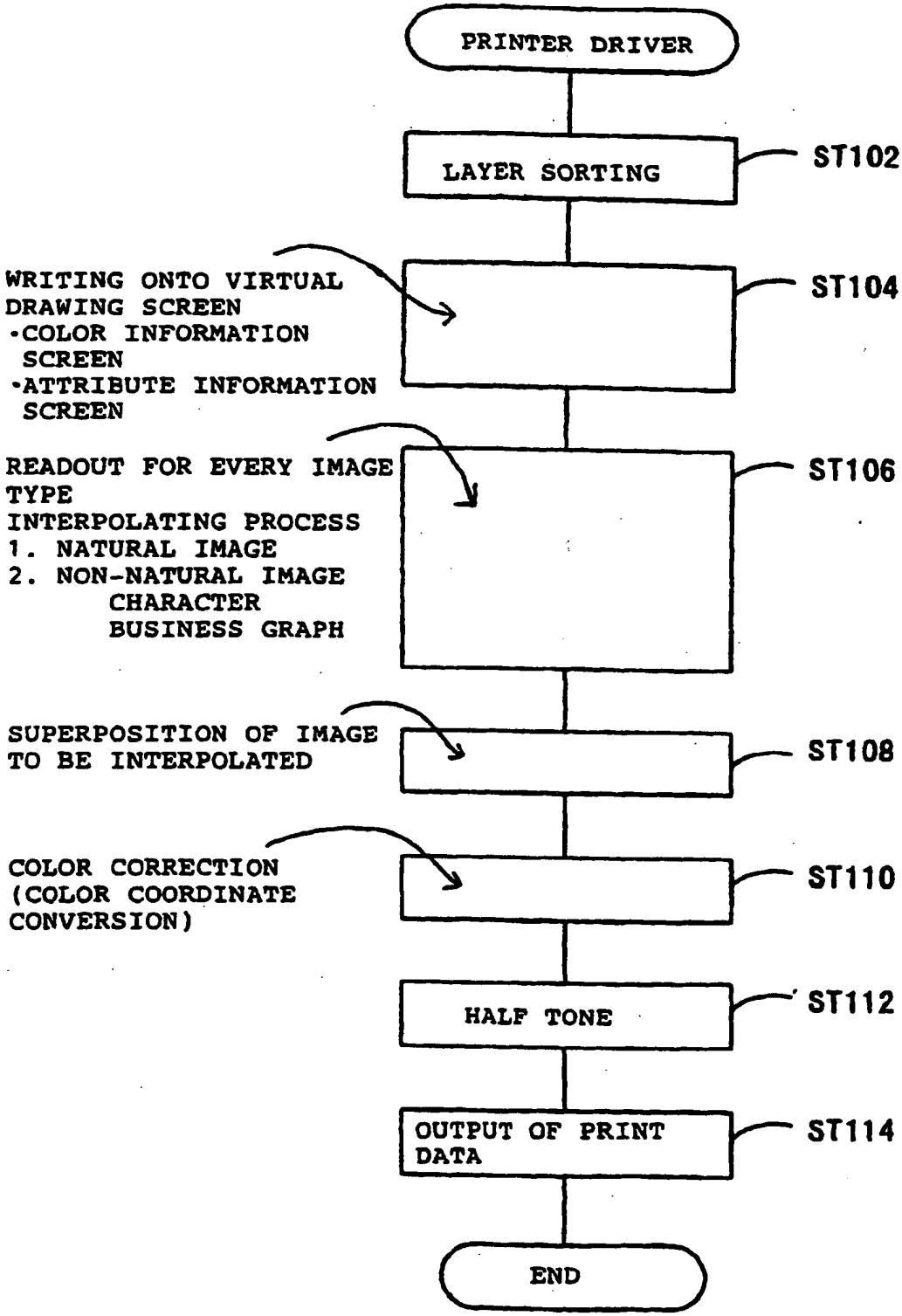

PRINTER DRIVER
LAYER SORTING
ST102
WRITING ONTO VIRTUAL DRAWING SCREEN
·COLOR INFORMATION SCREEN
·ATTRIBUTE INFORMATION SCREEN
ST104
READOUT FOR EVERY IMAGE TYPE
INTERPOLATING PROCESS
1. NATURAL IMAGE
2. NON-NATURAL IMAGE
CHARACTER
BUSINESS GRAPH
ST106
SUPERPOSITION OF IMAGE TO BE INTERPOLATED
ST108
COLOR CORRECTION (COLOR COORDINATE CONVERSION)
ST110
HALF TONE
ST112
OUTPUT OF PRINT DATA
ST114
END

Fig. 4

FIG.8

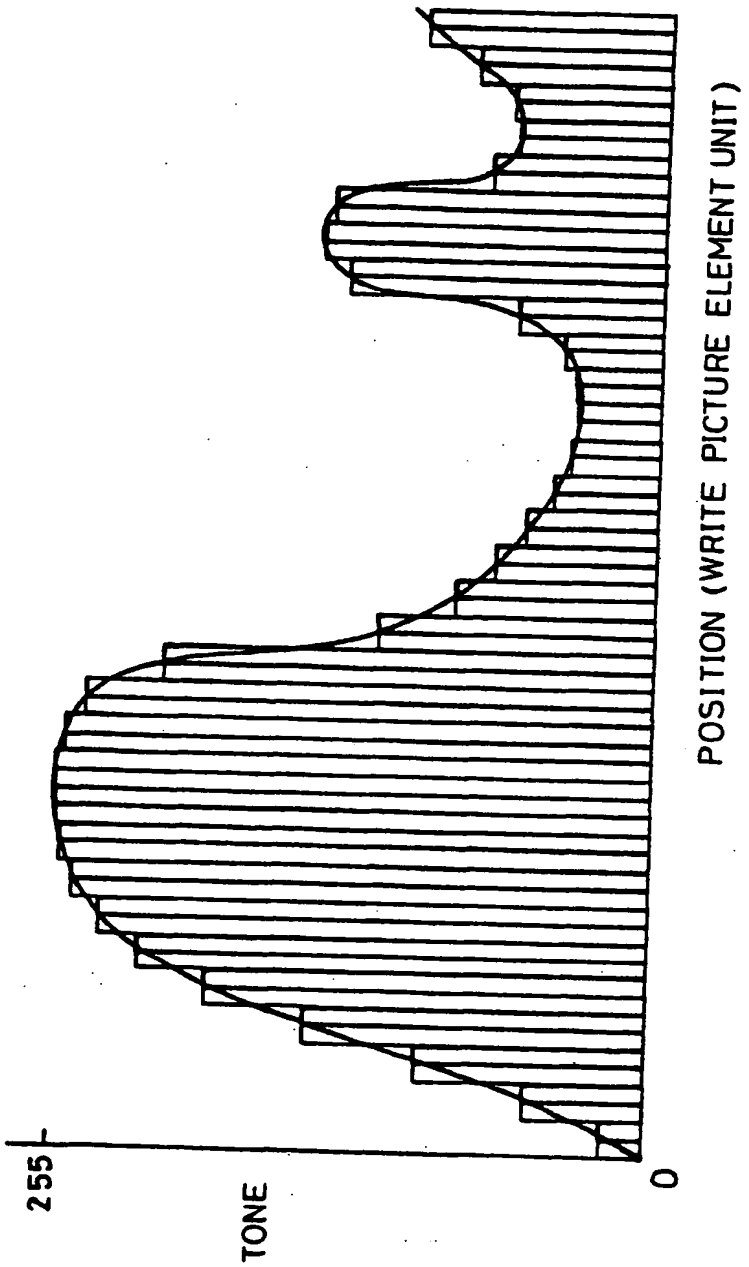


FIG.9

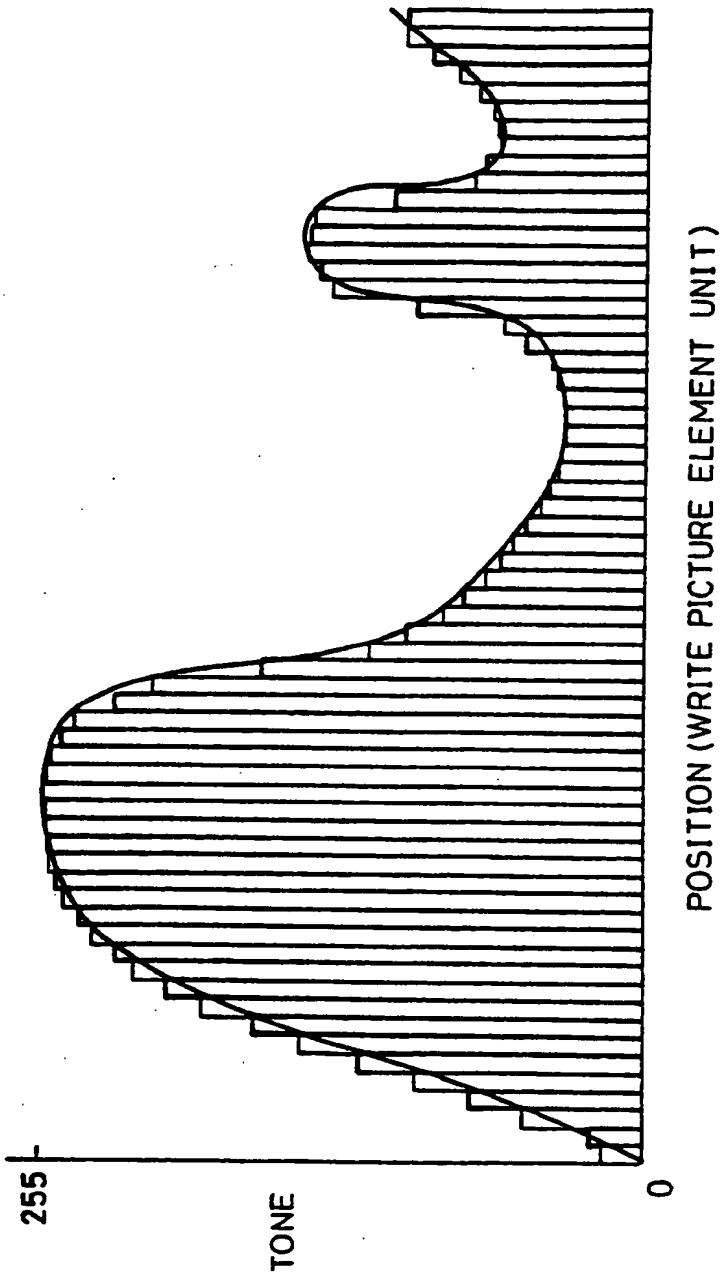


FIG.10

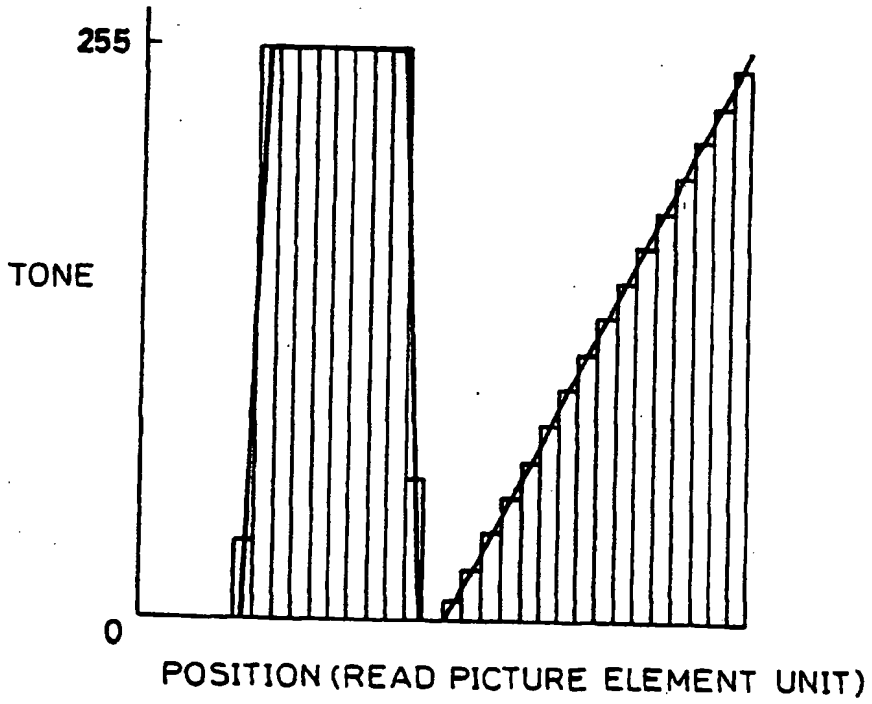


FIG.11

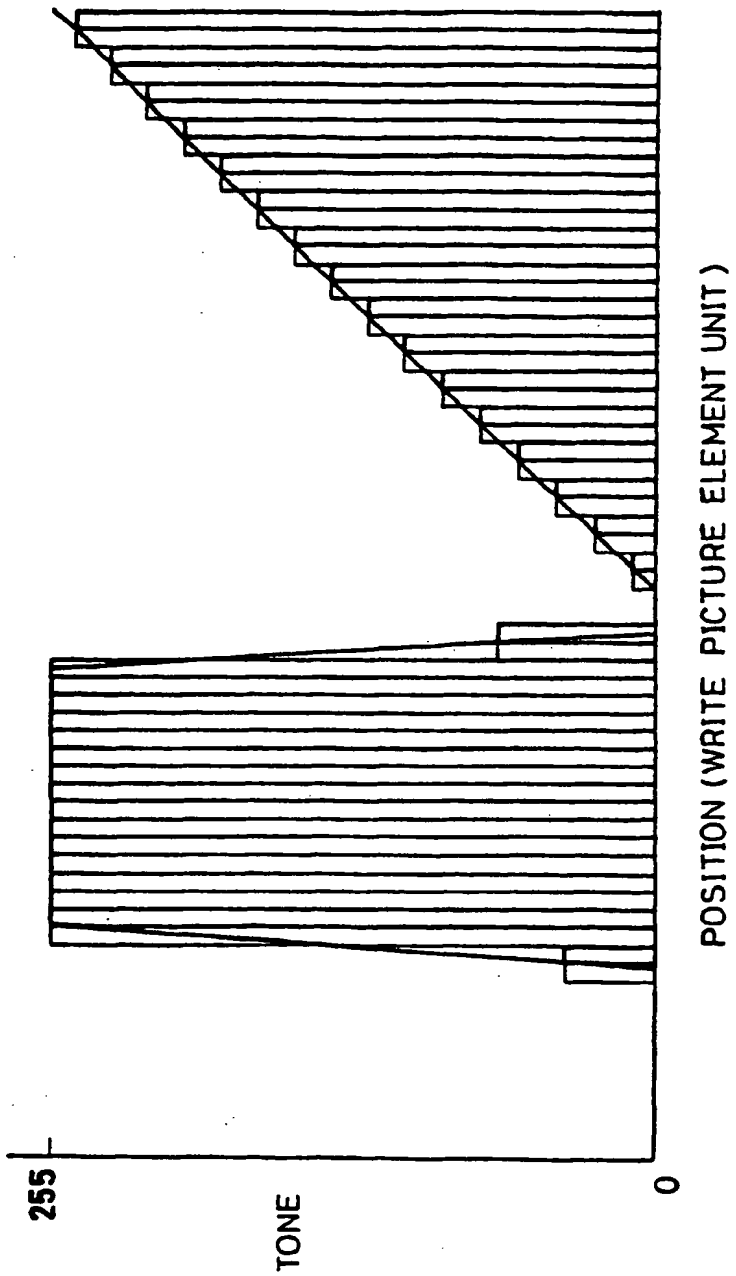


FIG.12

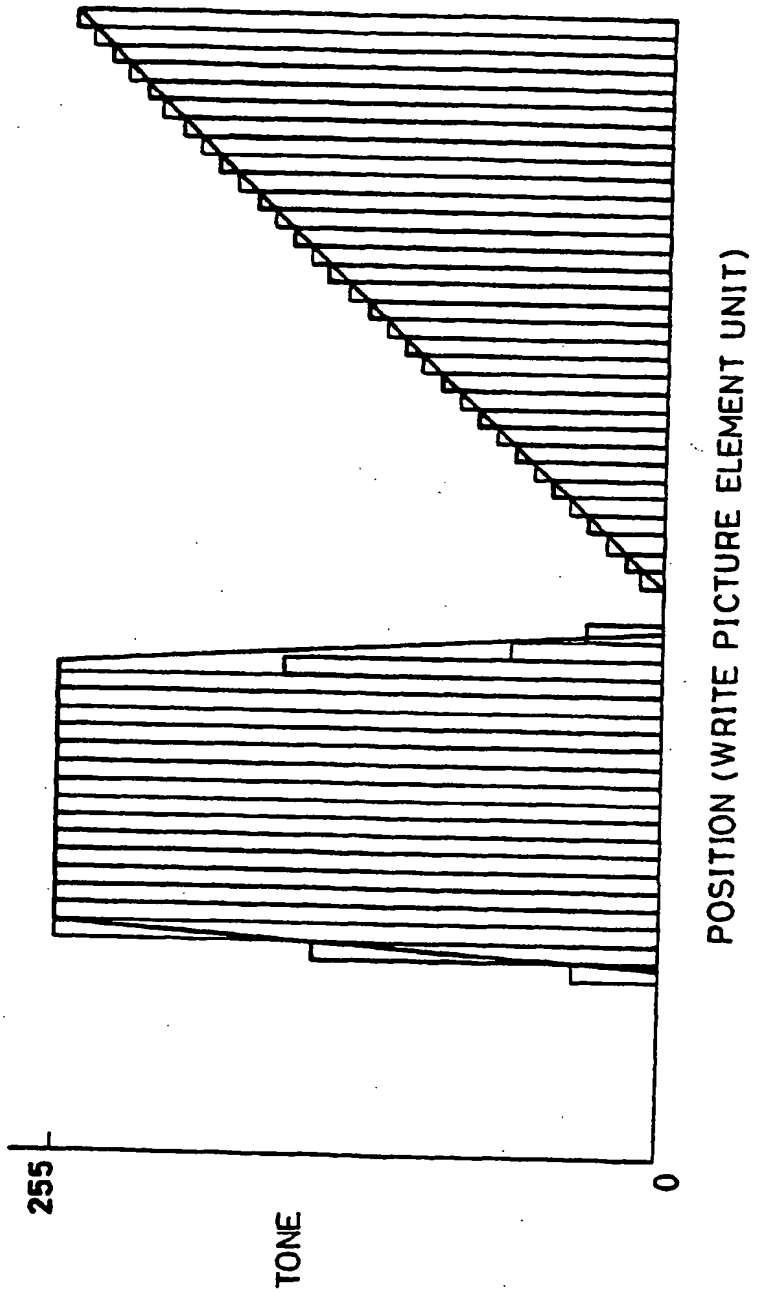


FIG.13

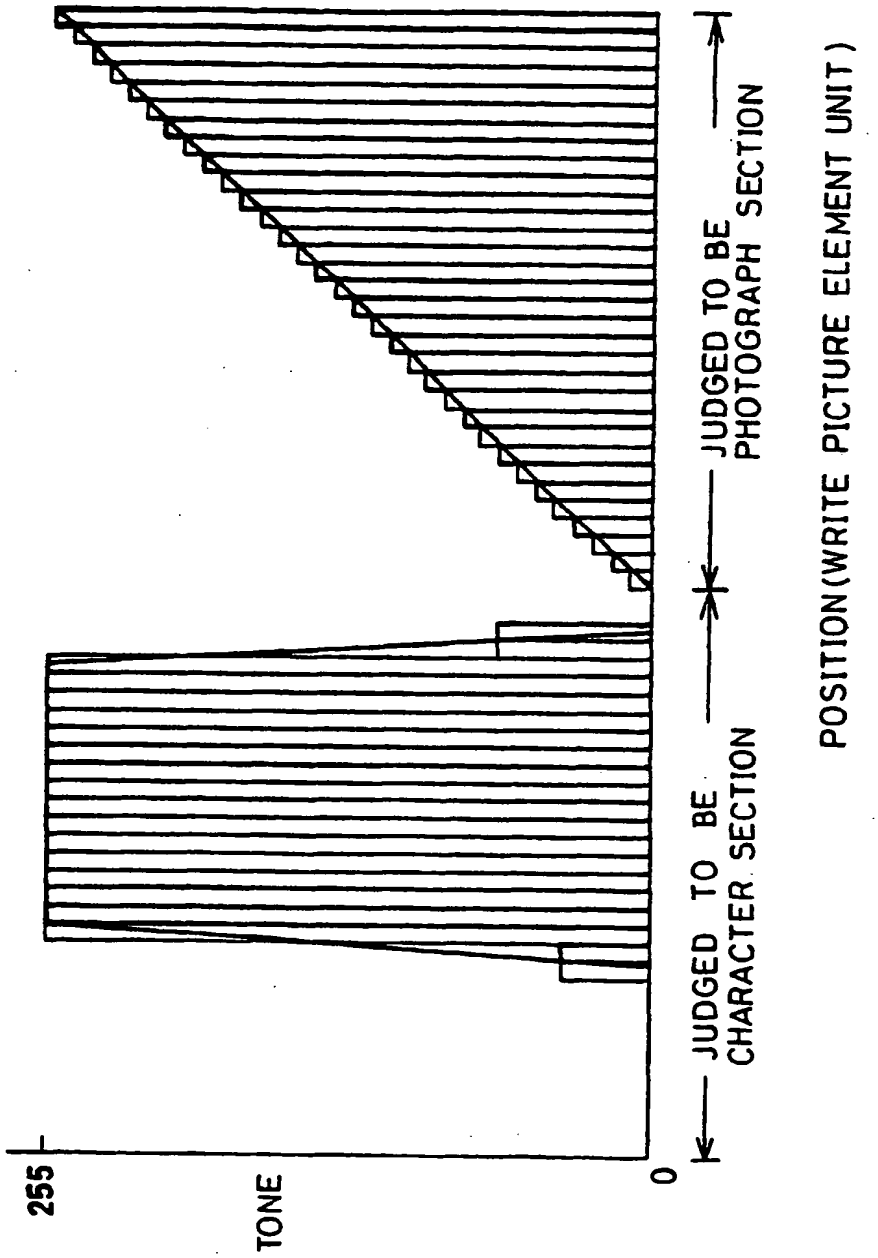


FIG.14

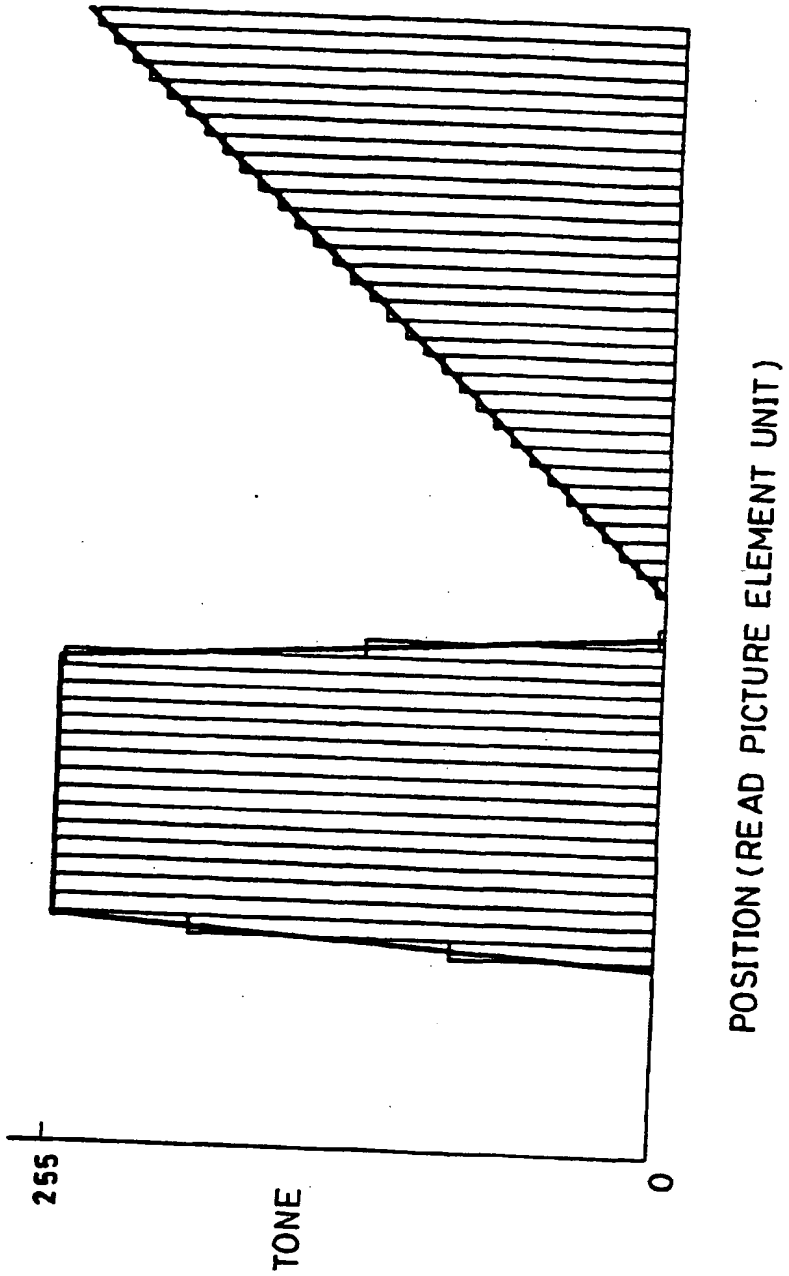


FIG.15

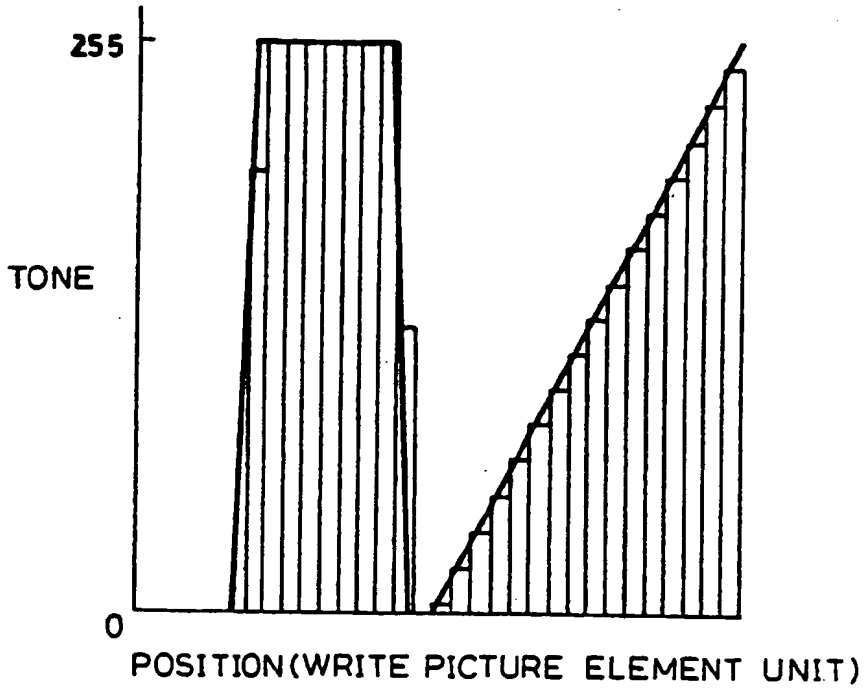


FIG.16

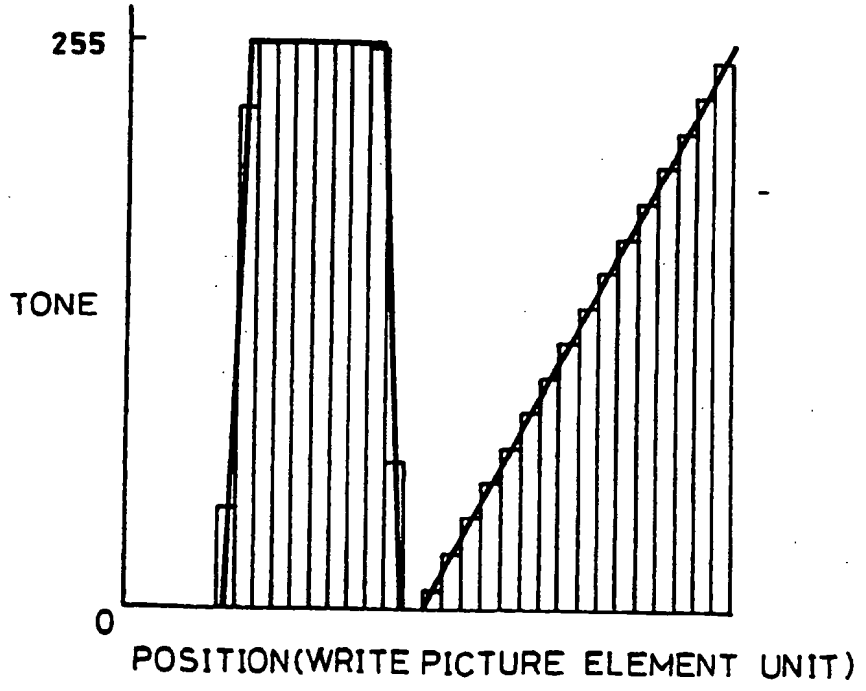


FIG.17

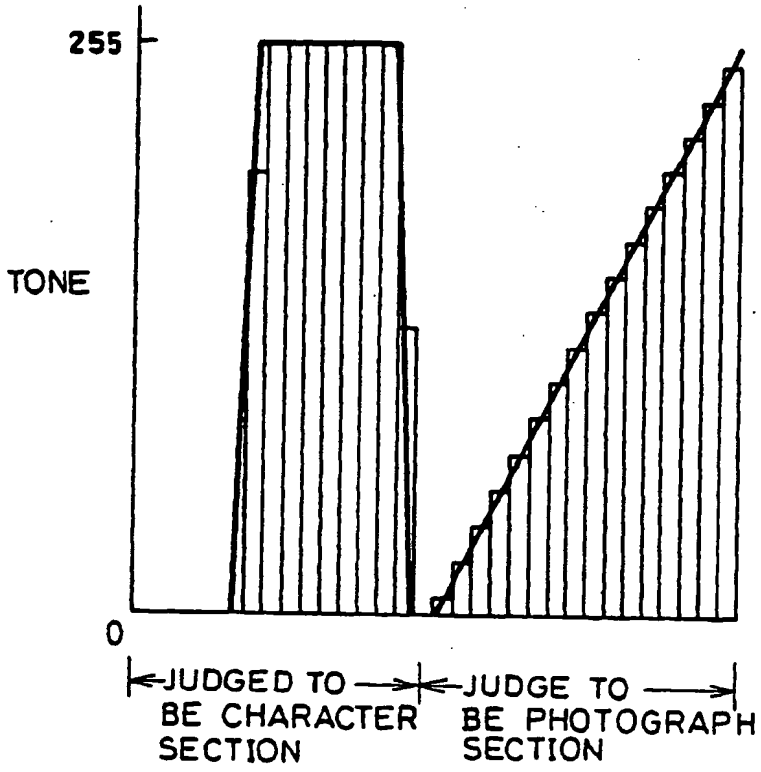


FIG.18

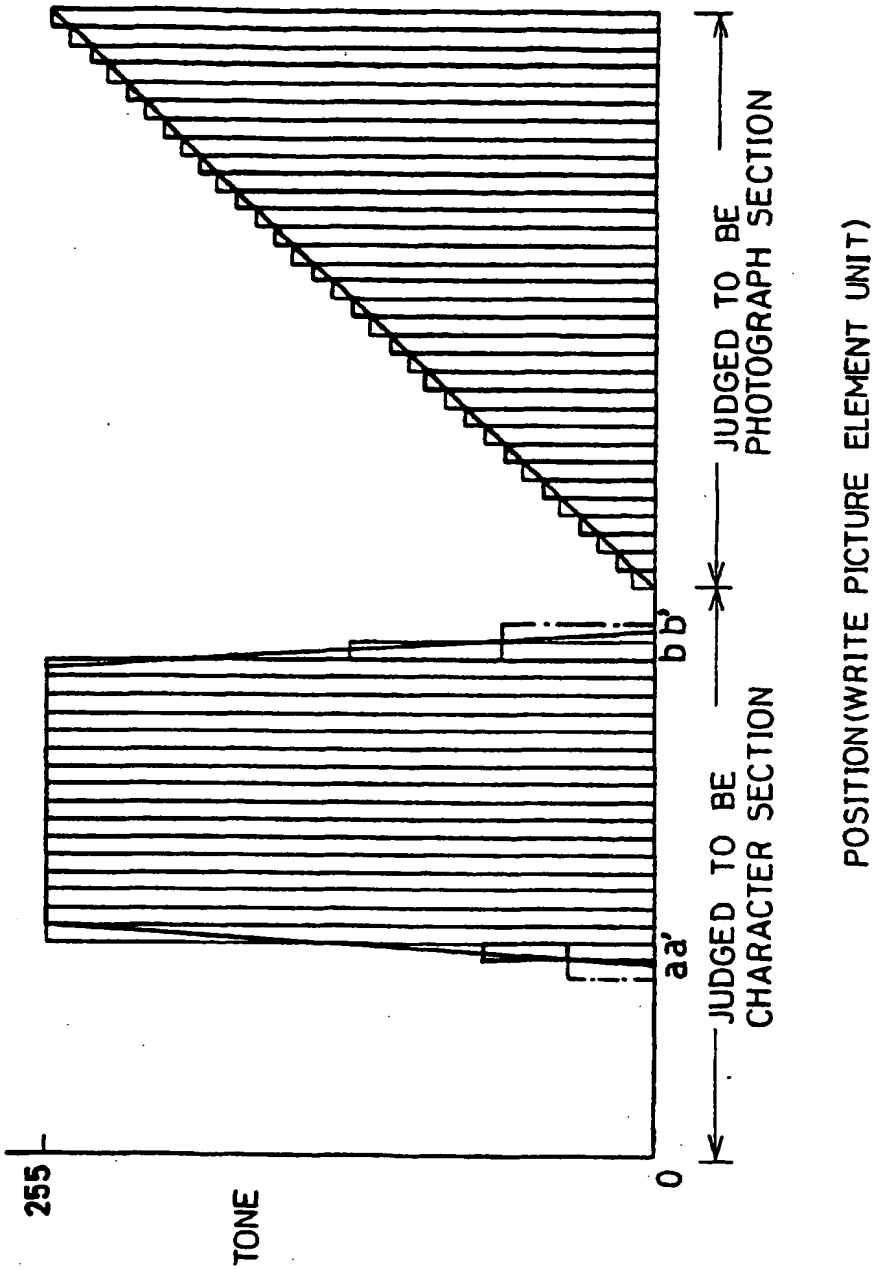


FIG.19(c)

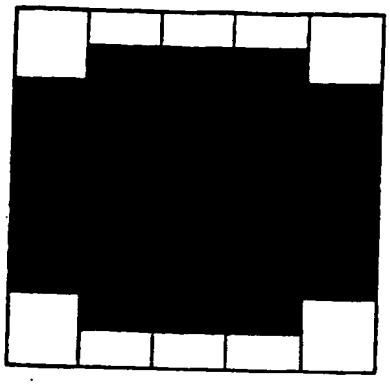


FIG.19(b)

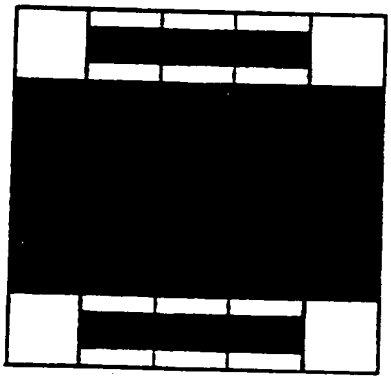


FIG.19(a)

00H	80H	80H	80H	00H
FFH	FFH	FFH	FFH	FFH
FFH	FFH	FFH	FFH	FFH
FFH	FFH	FFH	FFH	FFH
00H	80H	80H	80H	00H

8

FIG. 20

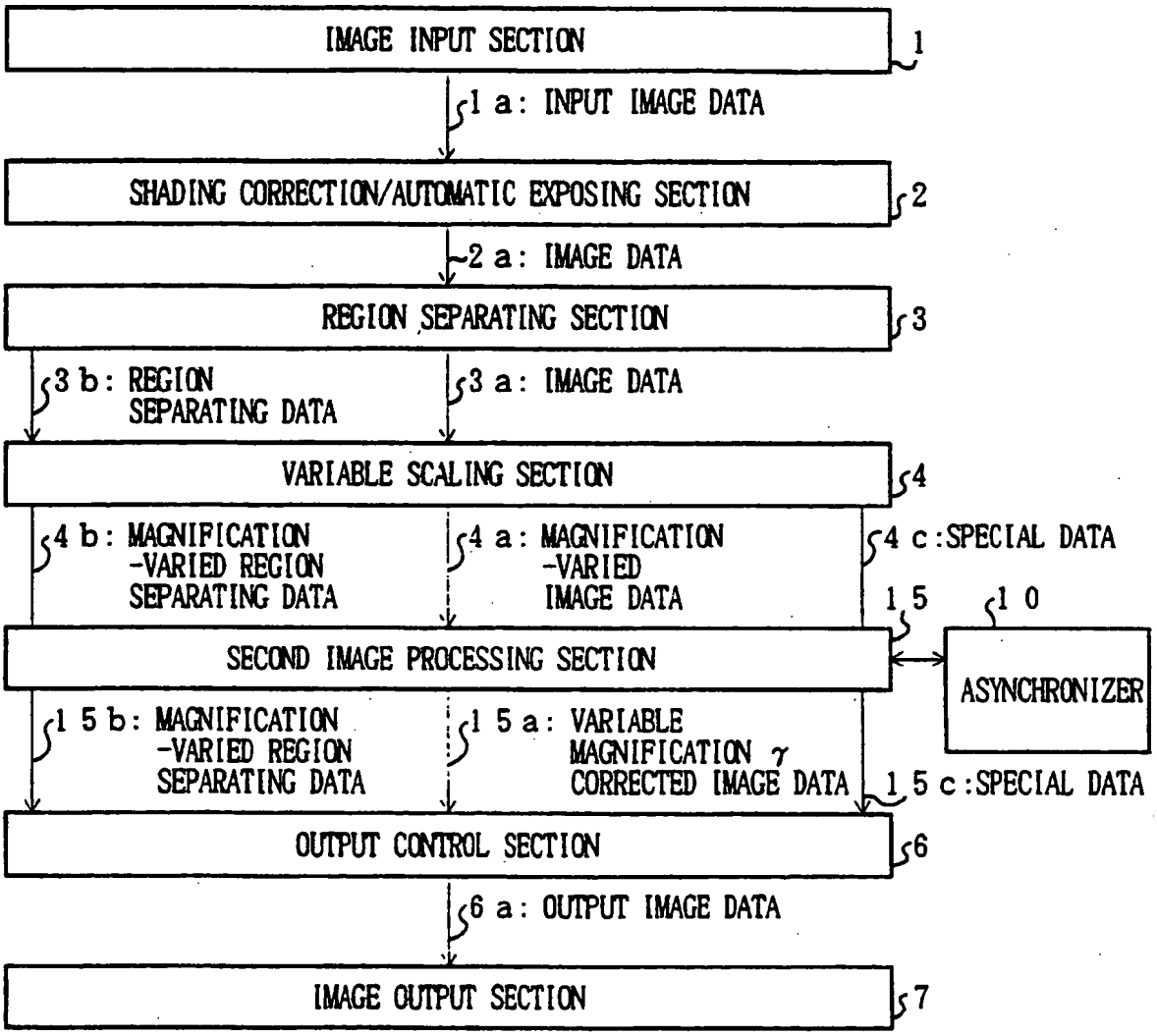


FIG. 21

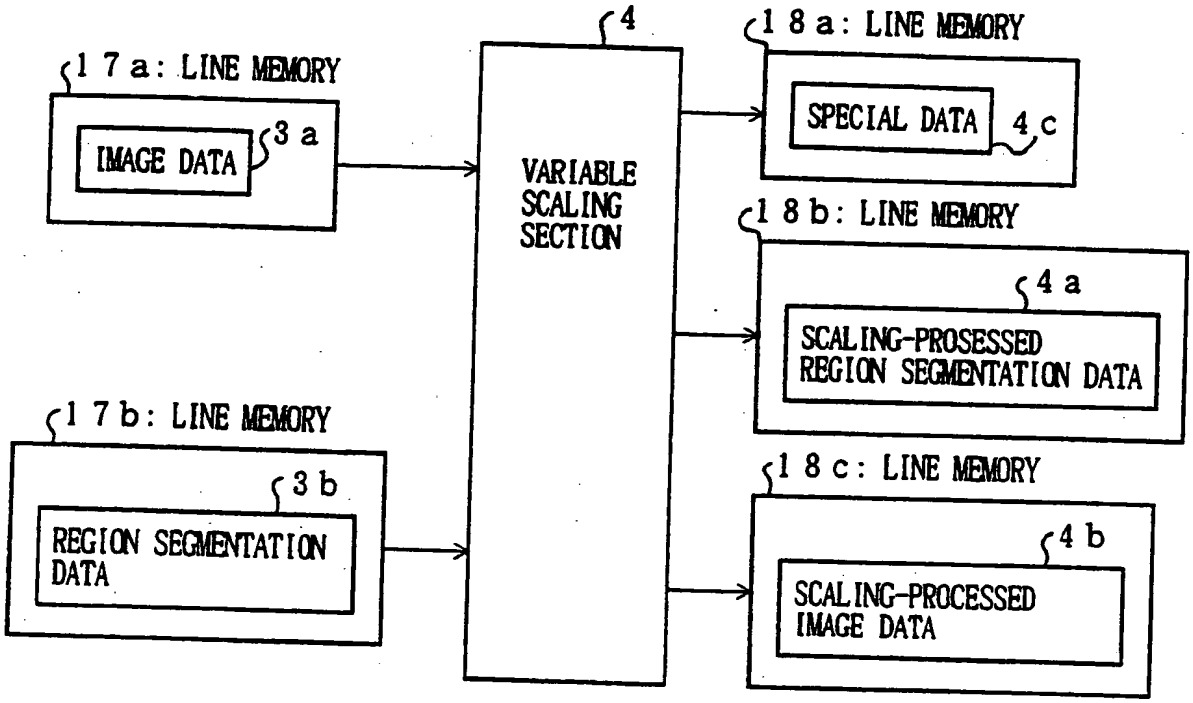


FIG. 22(a)

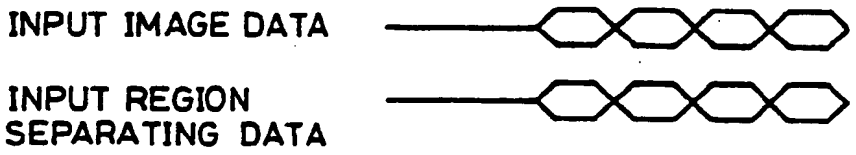


FIG. 22(b)

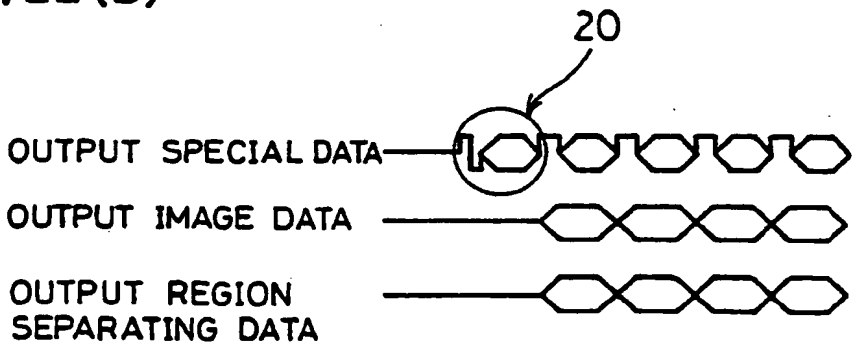


FIG. 23(a)

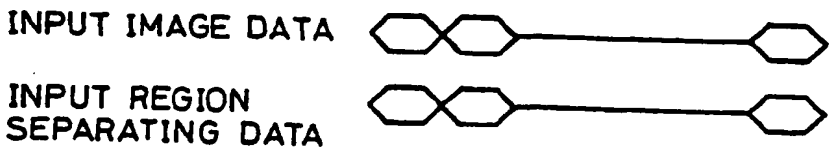


FIG. 23(b)

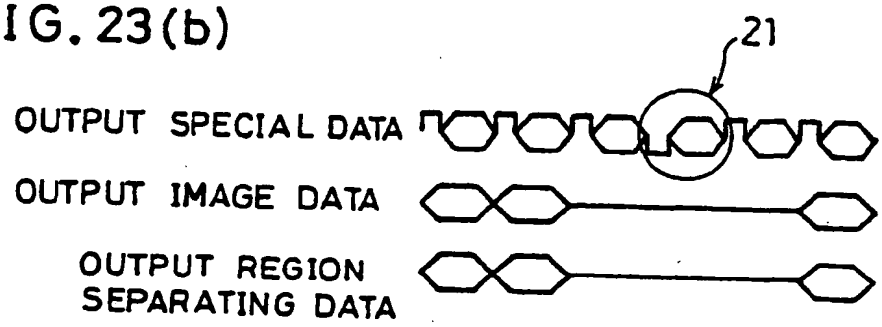


FIG. 24(a)

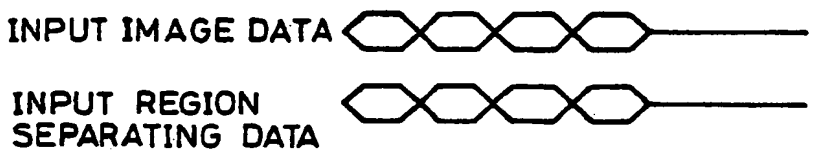
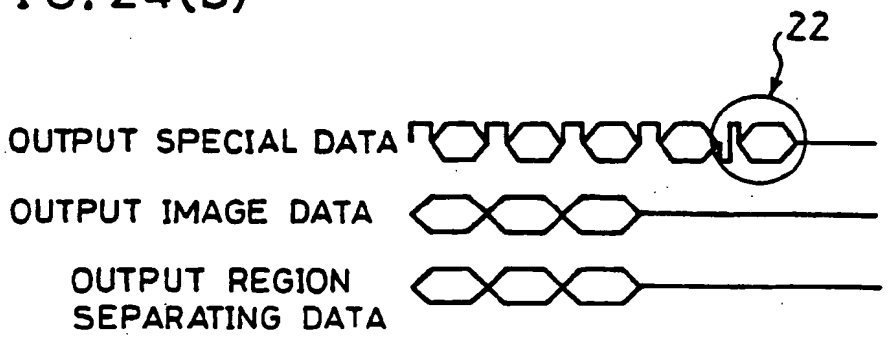


FIG. 24(b)



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 0541

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP 0 389 164 A (CANON KK) 26 September 1990 * abstract; figure 1 * * page 5, line 30 - line 46 *	1,15	G06T3/40 H04N1/393
X	PATENT ABSTRACTS OF JAPAN vol. 017, no. 519 (P-1615), 17 September 1993 & JP 05 135165 A (TOSHIBA CORP), 1 June 1993, * abstract *	1,15	
A	EP 0 645 736 A (CANON KK) 29 March 1995 * abstract; figures 1-3,25-27 *	1,15	
A	EP 0 407 213 A (TOSHIBA KK) 9 January 1991 * abstract; figures 1-6,9-17 *	1,15	
A	WO 90 16034 A (EASTMAN KODAK CO) 27 December 1990 * abstract; figures 1-26 *	1,15	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	PATENT ABSTRACTS OF JAPAN vol. 095, no. 006, 31 July 1995 & JP 07 066976 A (RICOH CO LTD), 10 March 1995, * abstract *	1,15	G06T H04N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	28 April 1997	Kassow, H

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

FIG. 1

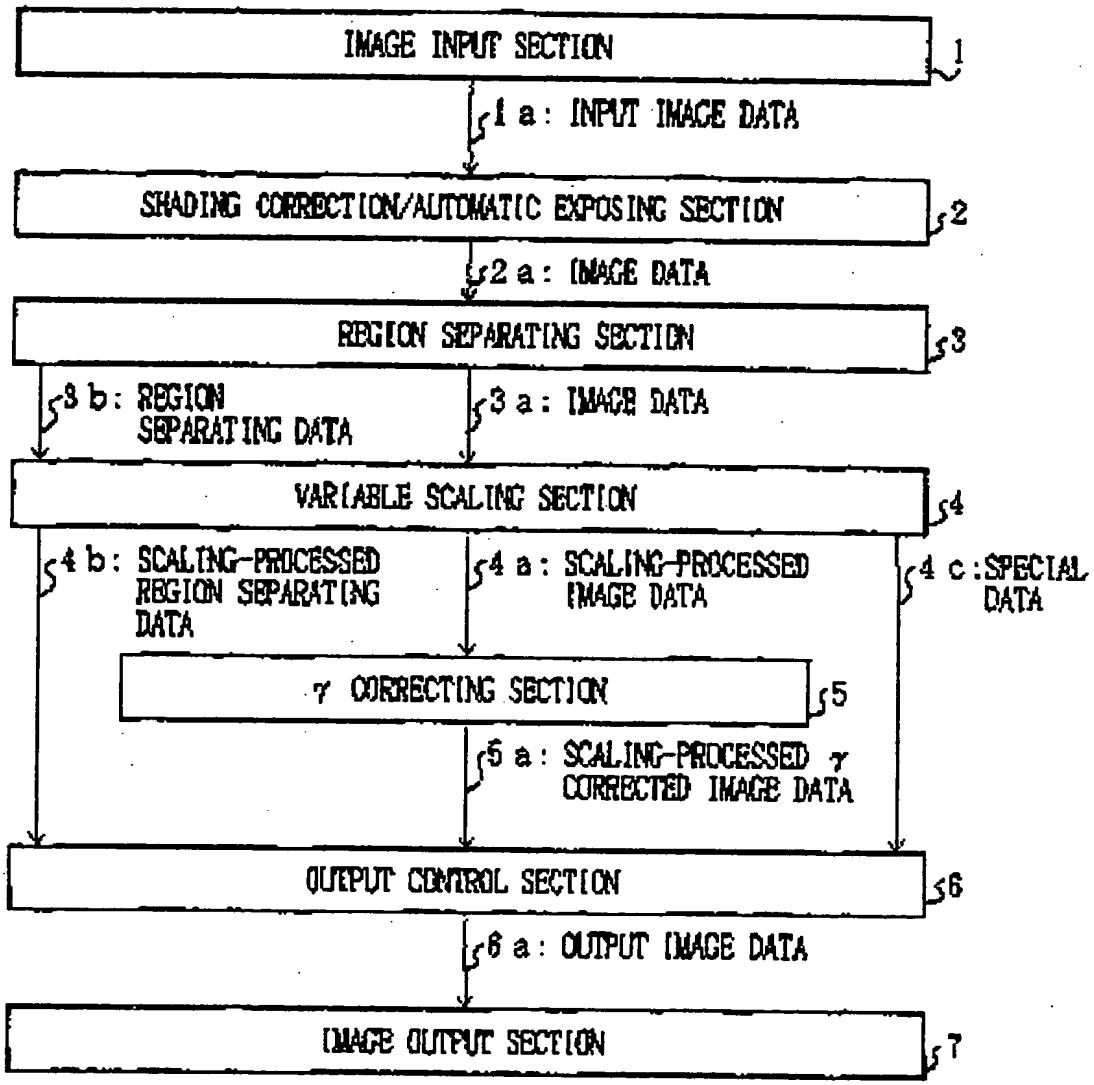


FIG. 2

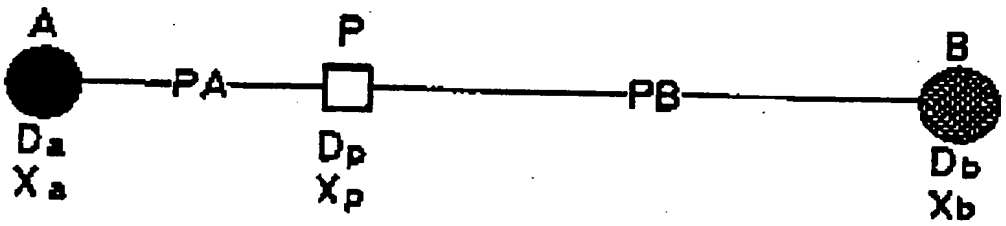


FIG. 3

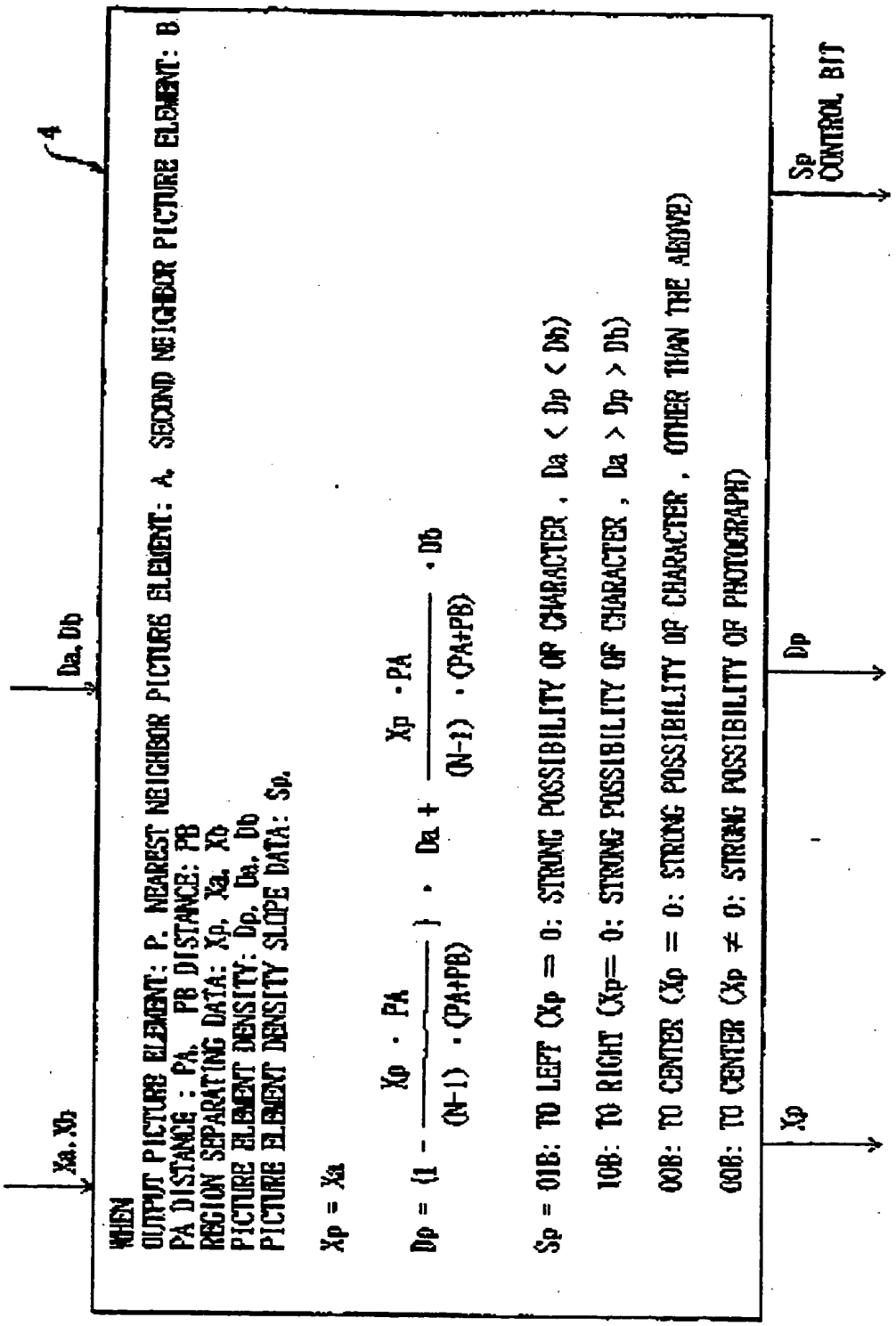


FIG. 4

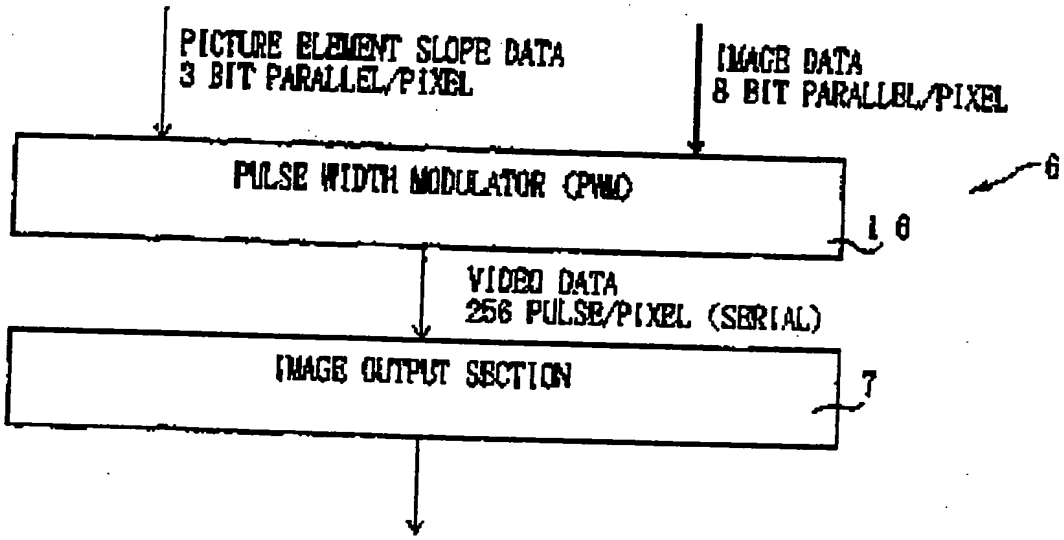


FIG.5(a)

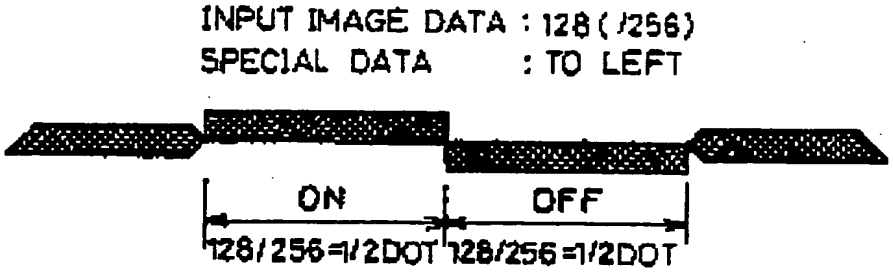


FIG.5(b)

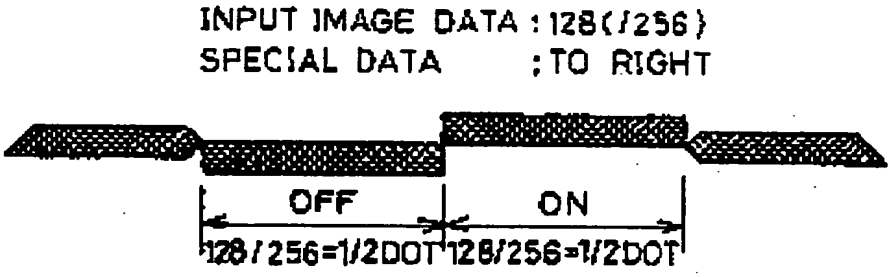


FIG.5(c)

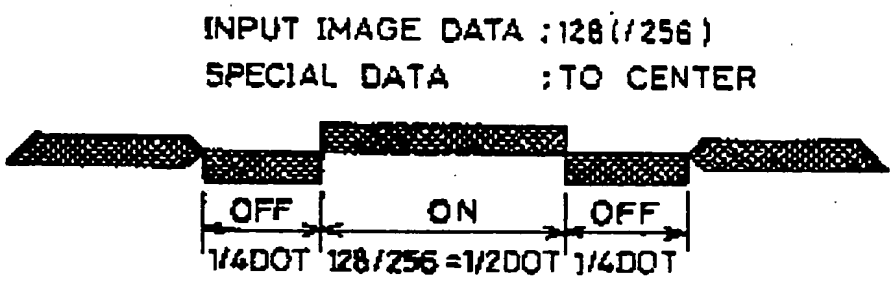


FIG.6

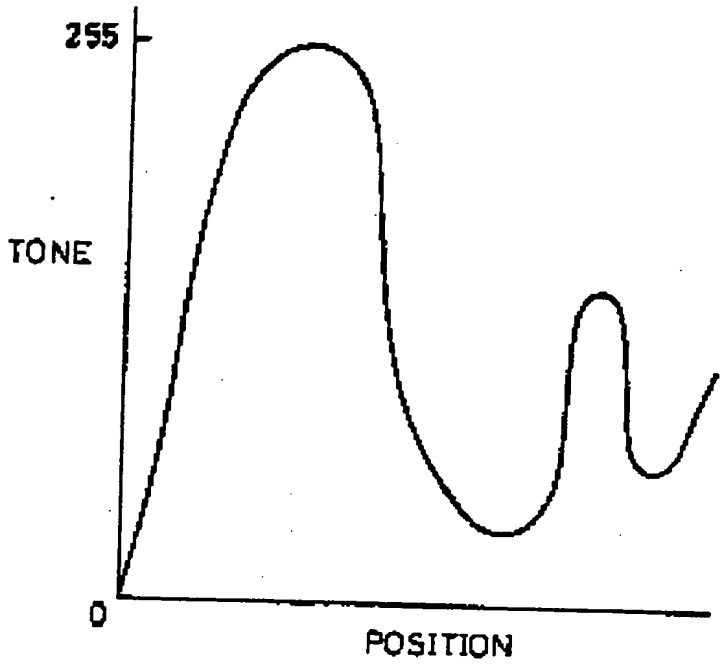


FIG.7

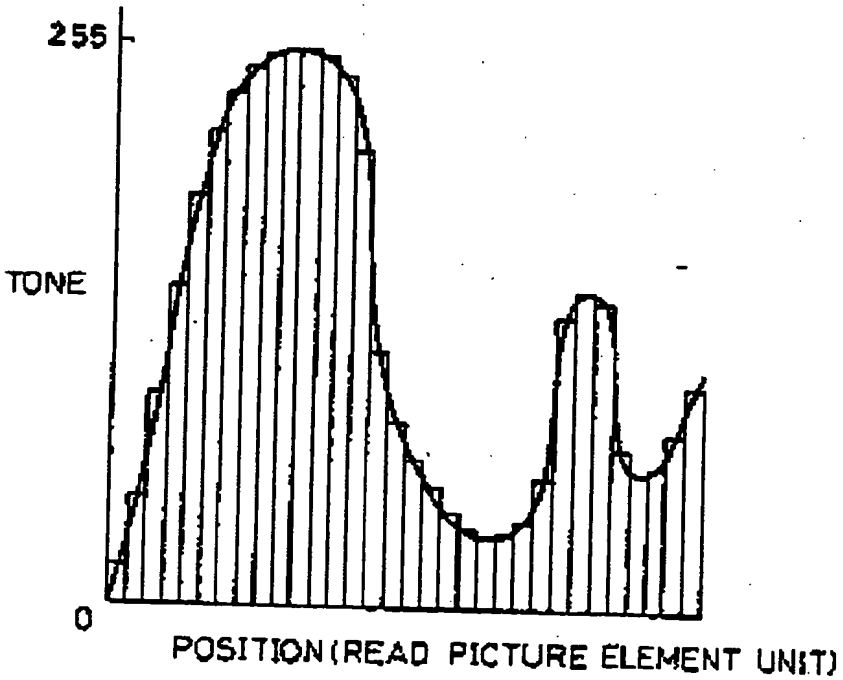


FIG.8

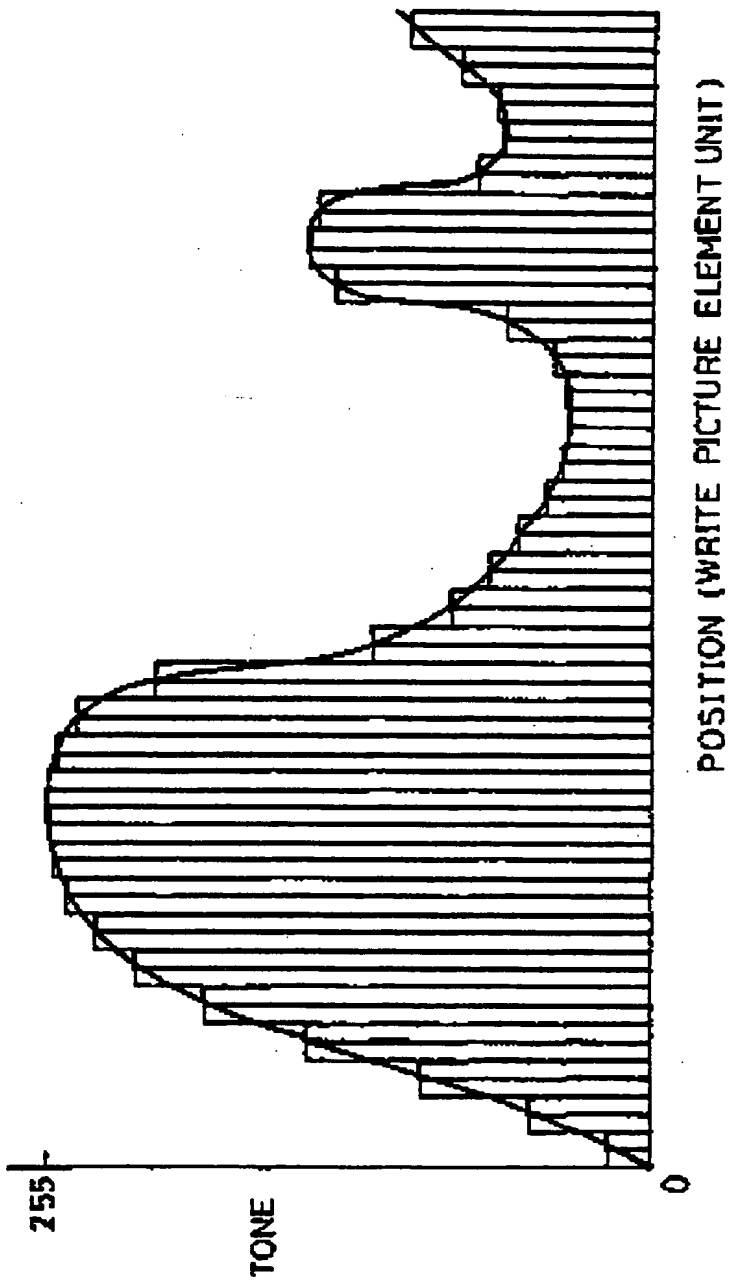


FIG.9

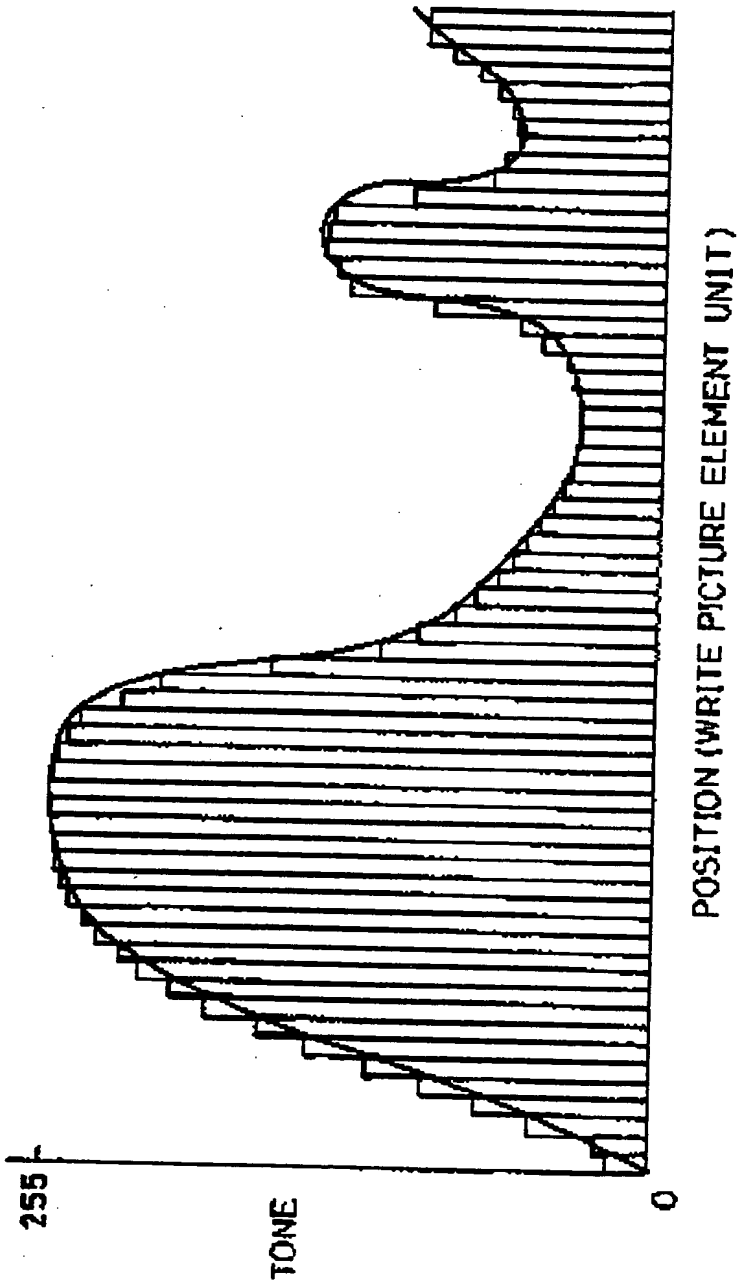


FIG.10

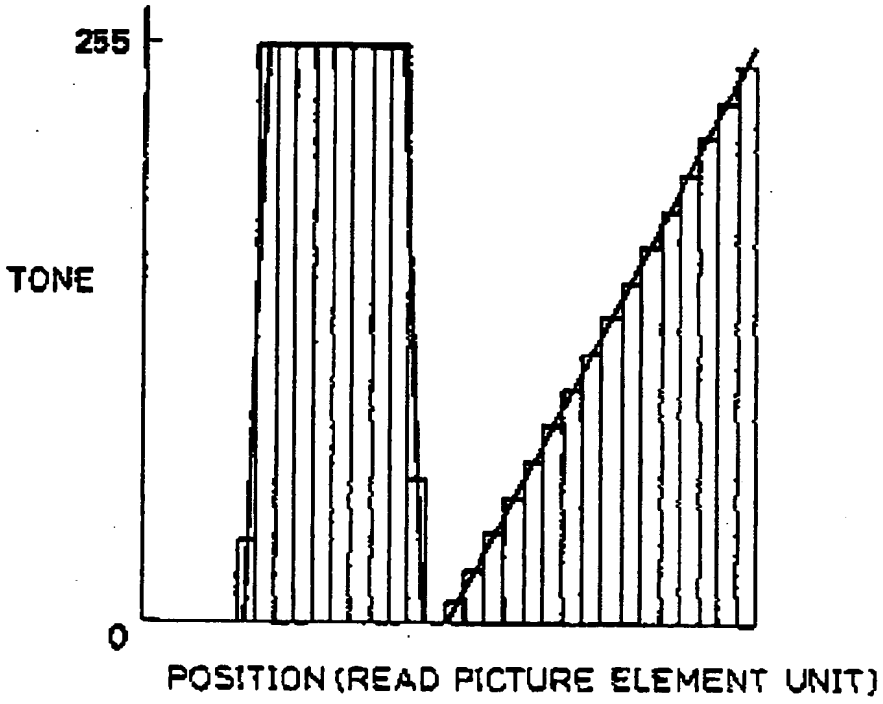


FIG.11

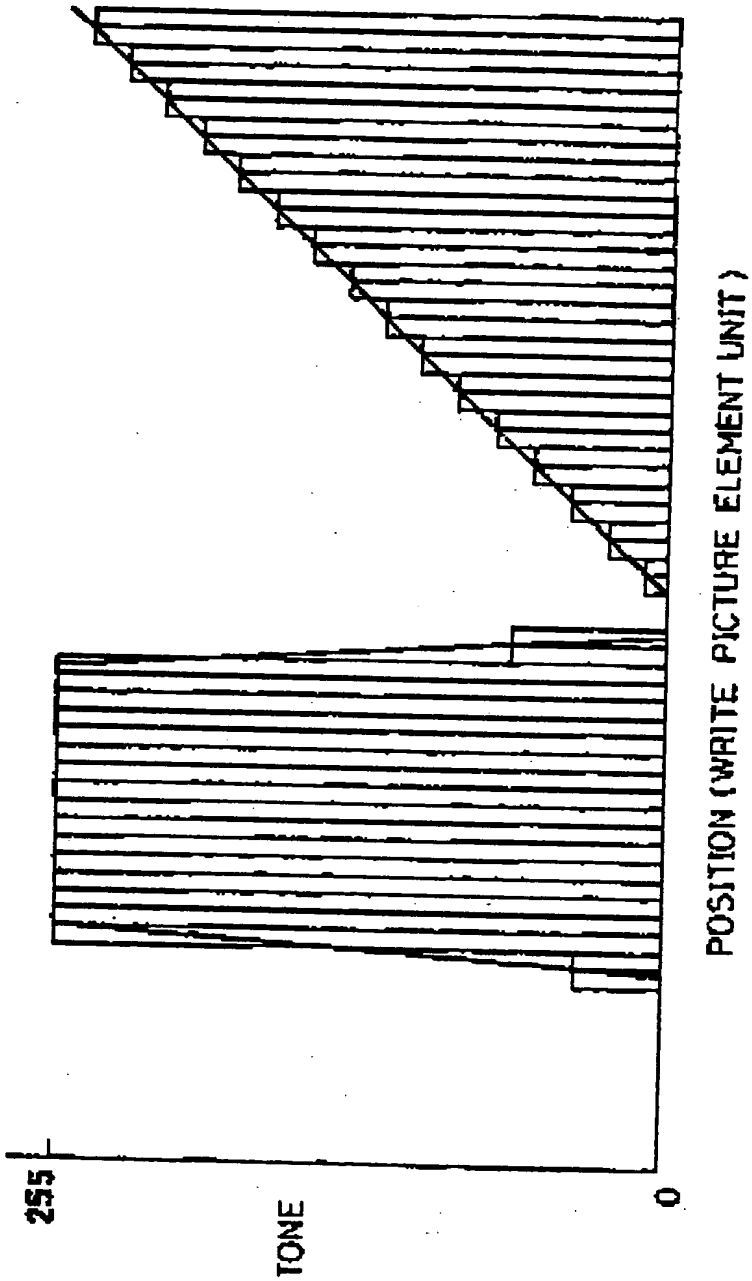


FIG.12

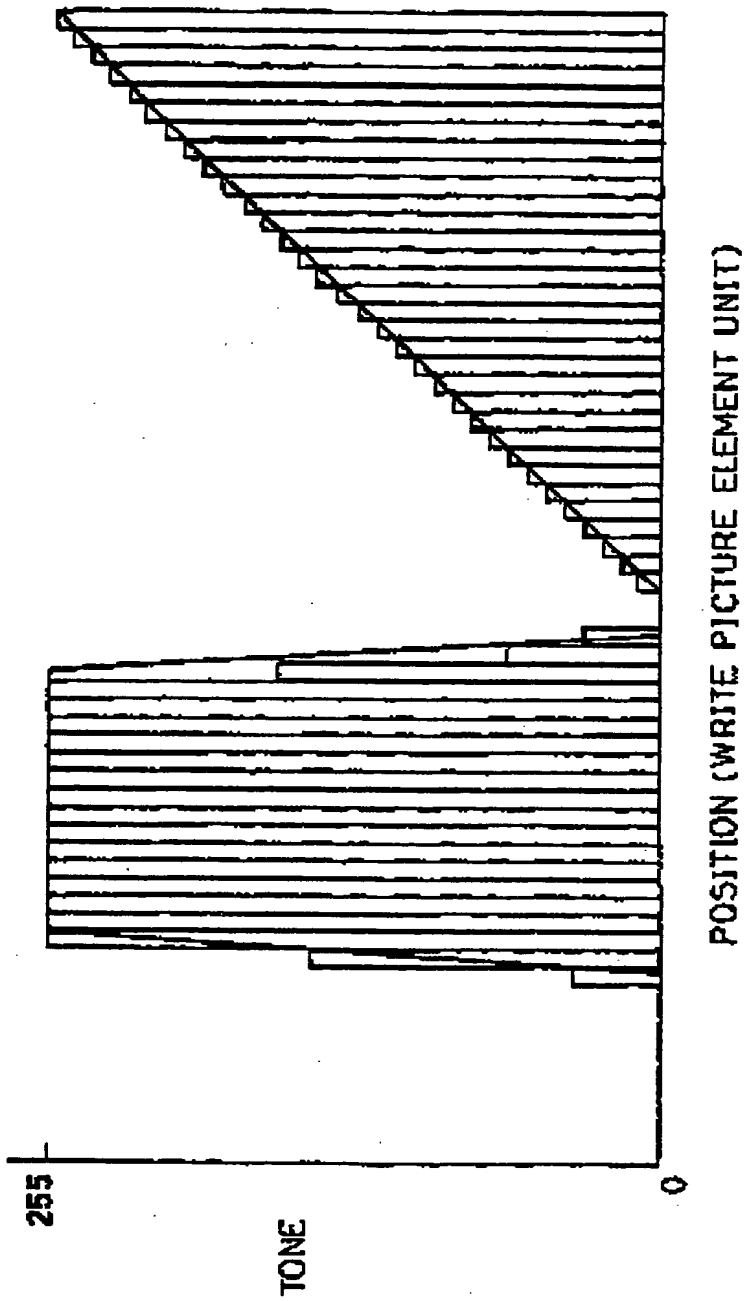


FIG.13

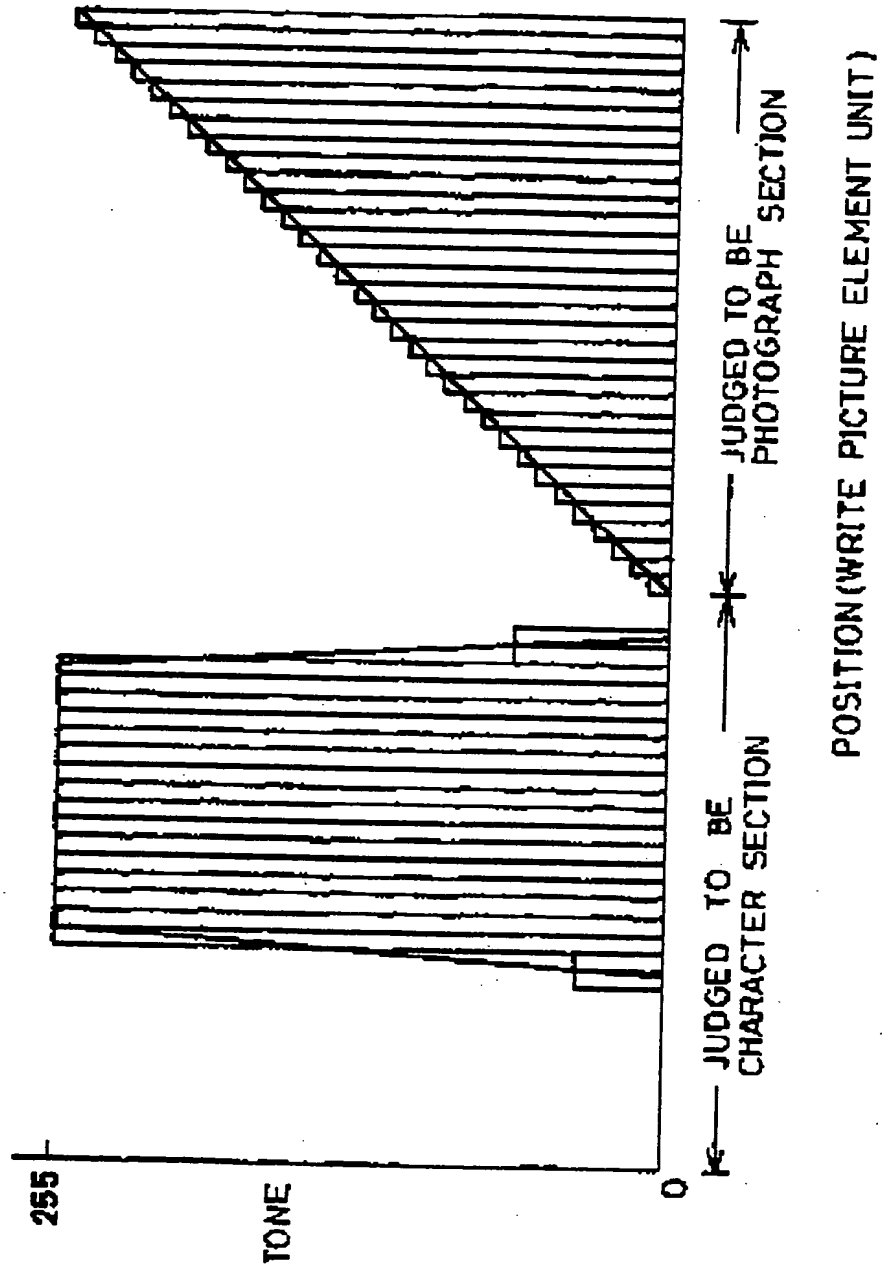


FIG.14

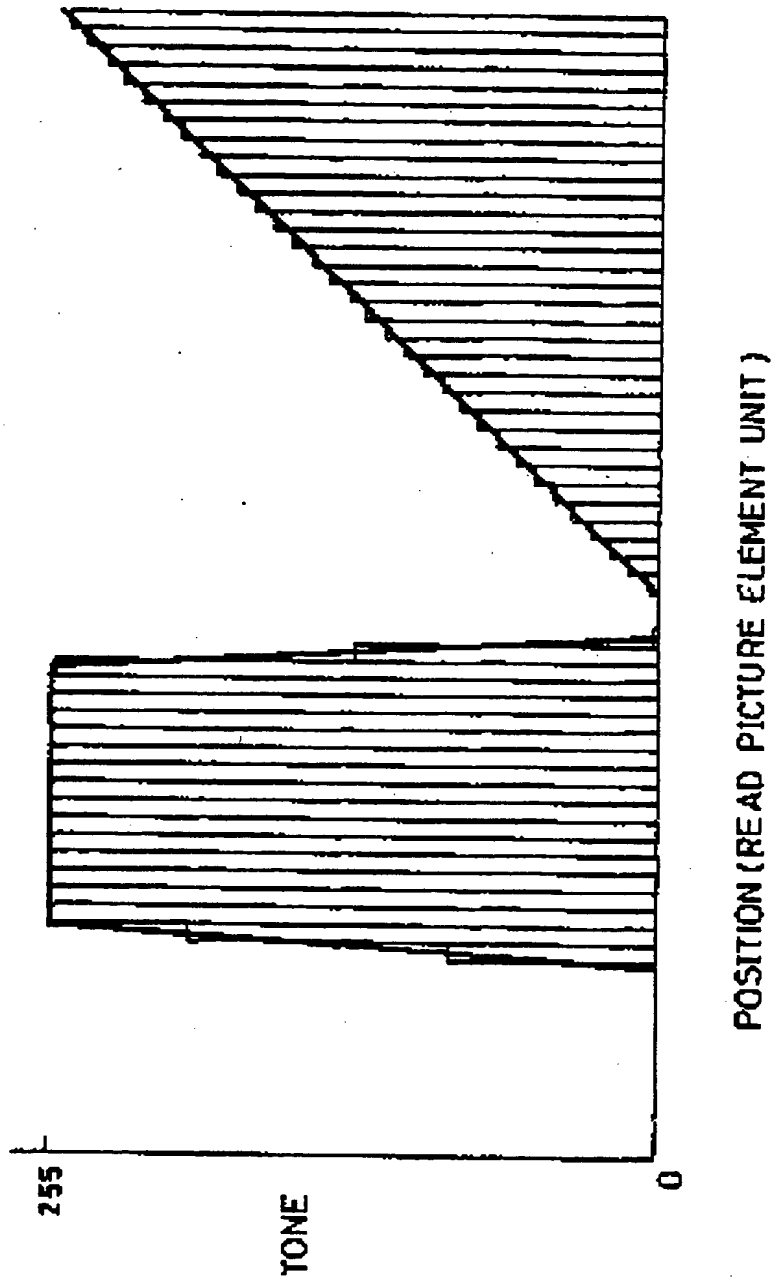


FIG.15

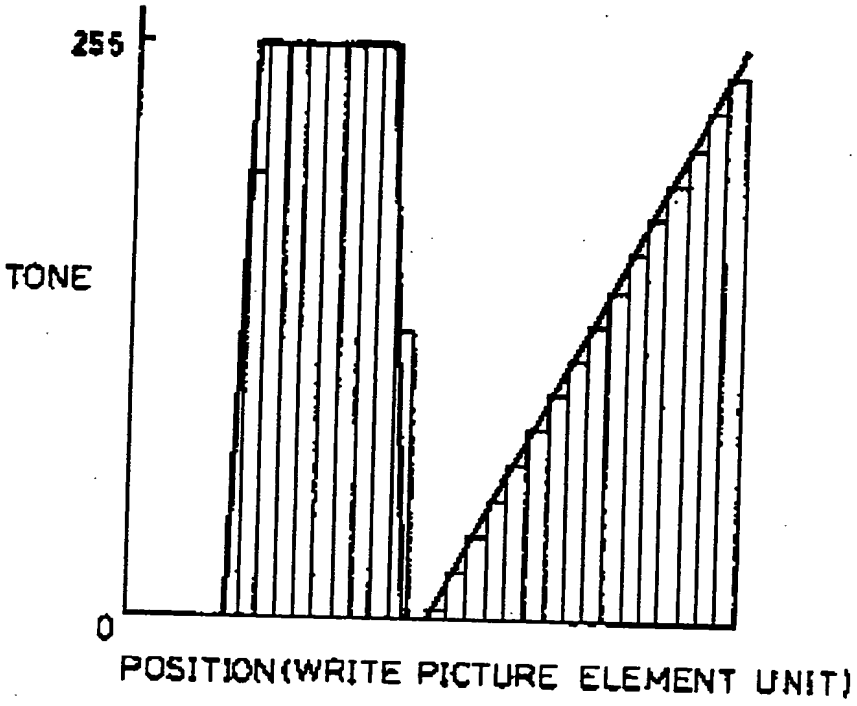


FIG.16

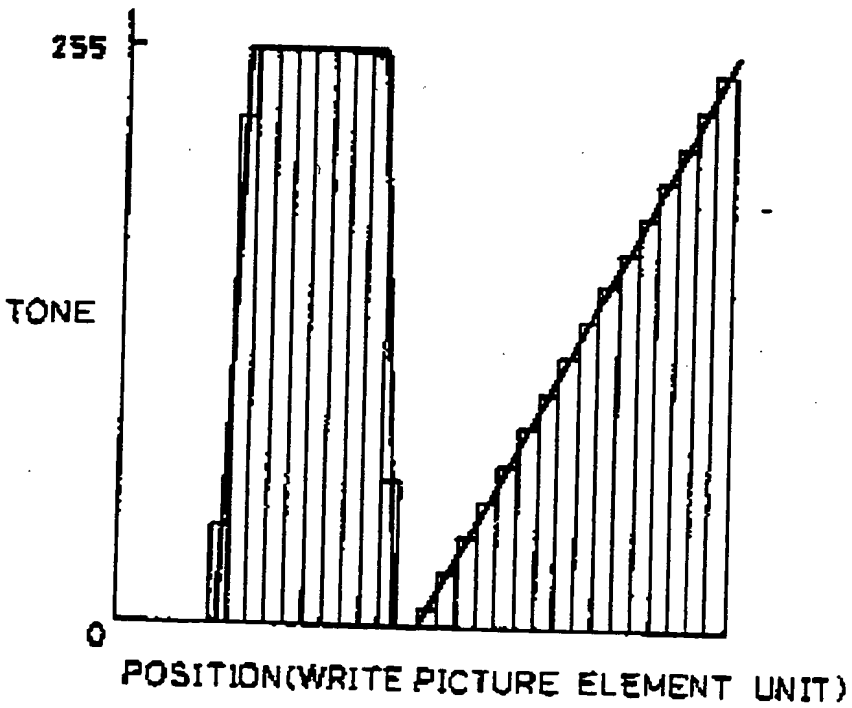


FIG.17

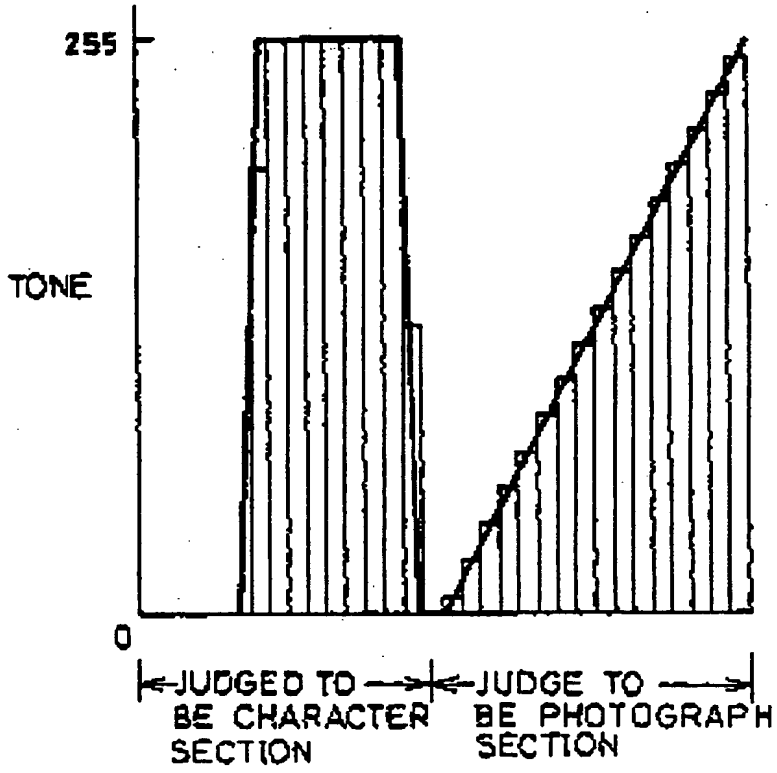


FIG.18

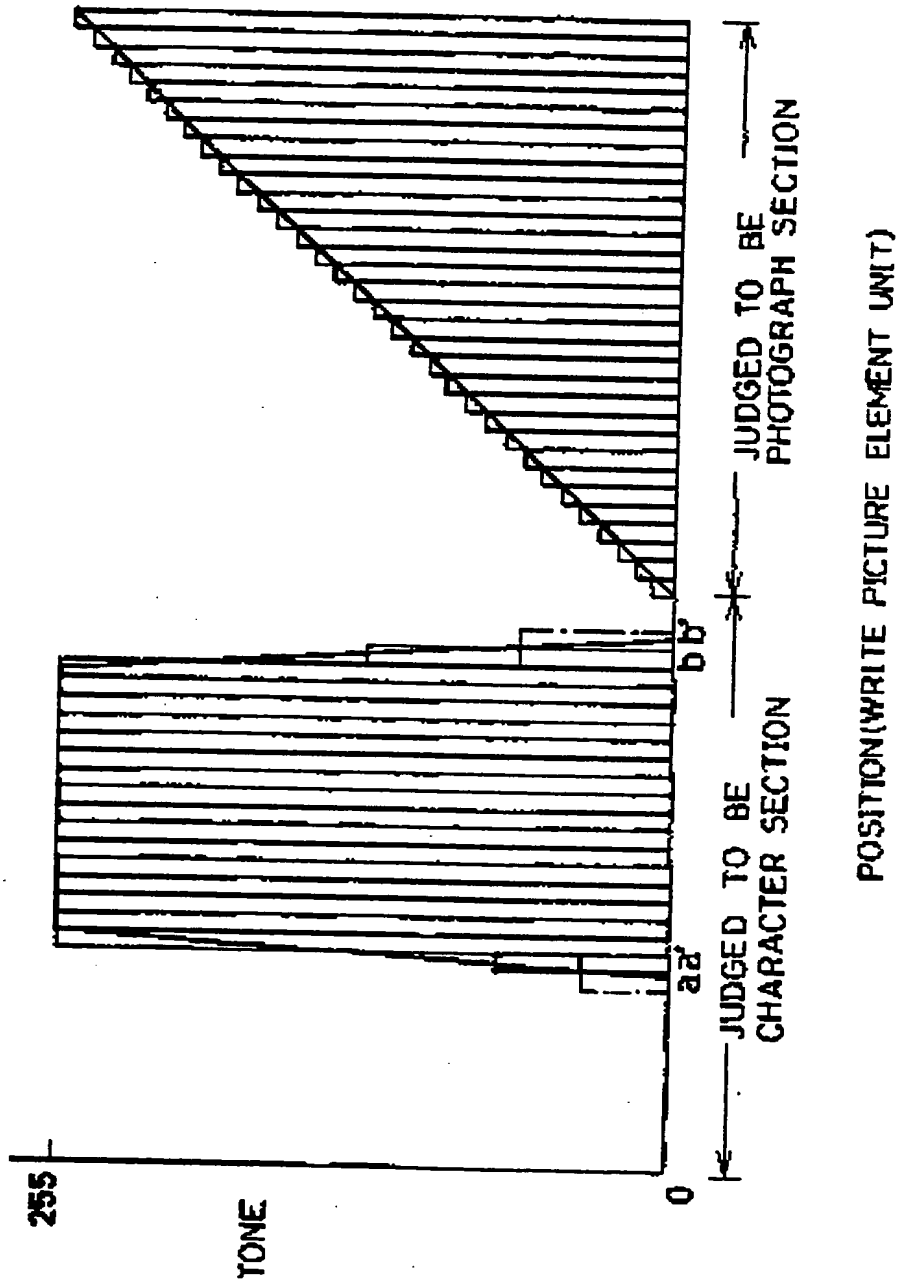


FIG.19(c)

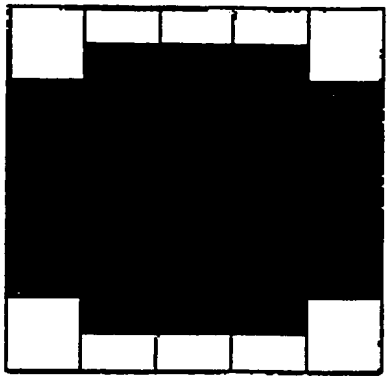


FIG.19(b)

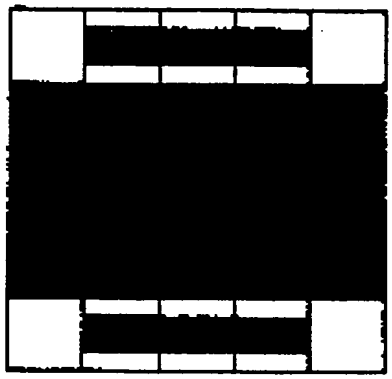


FIG.19(a)

00H	FFH	FFH	FFH	FFH	00H
80H	FFH	FFH	FFH	FFH	00H
80H	FFH	FFH	FFH	FFH	80H
80H	FFH	FFH	FFH	FFH	80H
00H	FFH	FFH	FFH	FFH	80H

8

FIG. 20

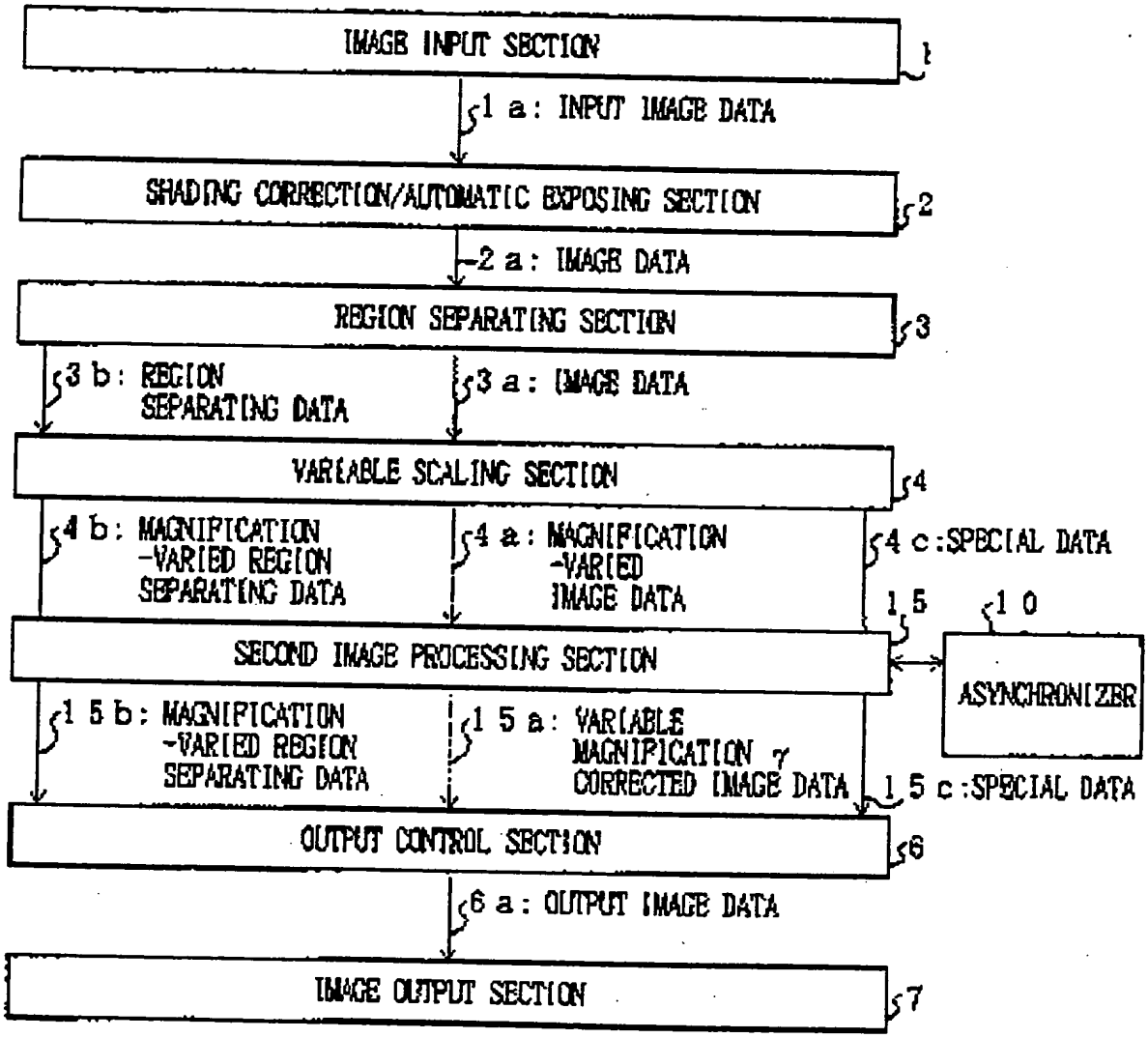


FIG. 21

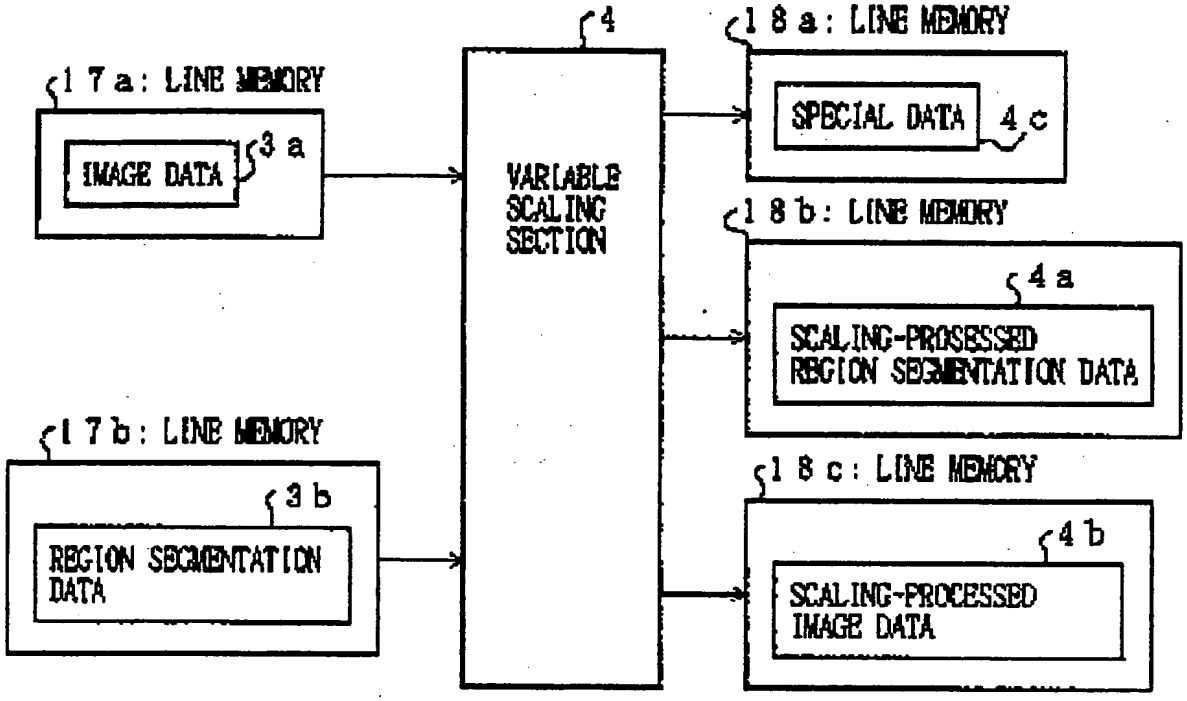


FIG. 22(a)

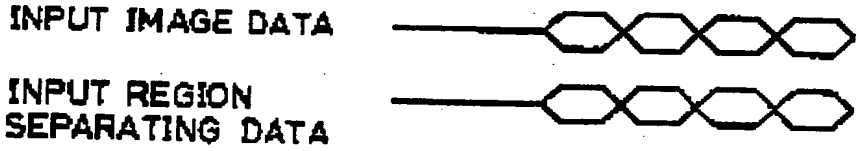


FIG. 22(b)

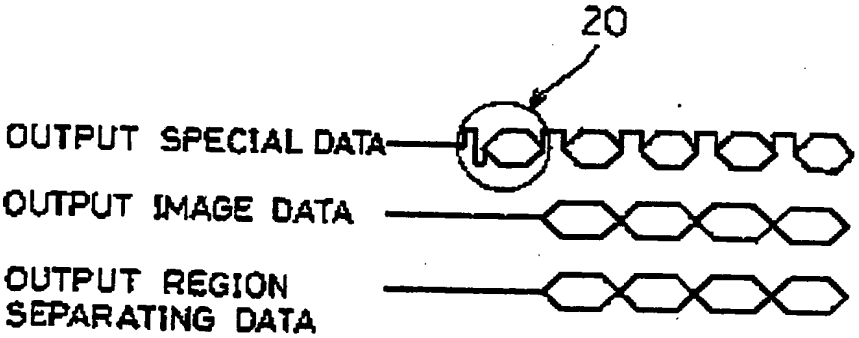


FIG. 23(a)

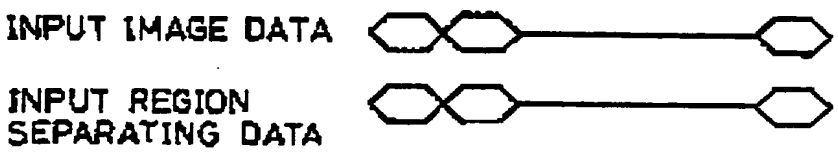


FIG. 23(b)

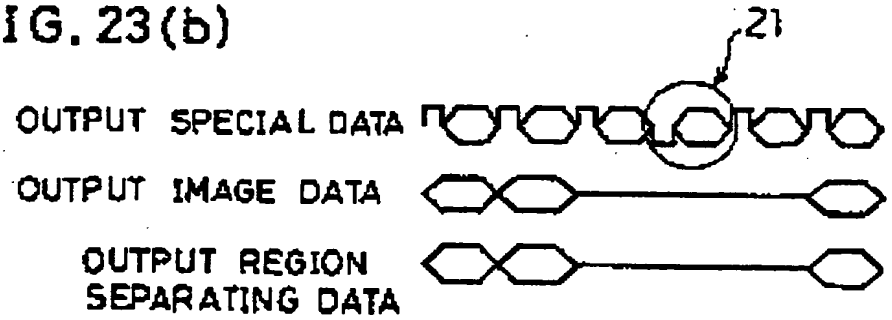


FIG. 24(a)

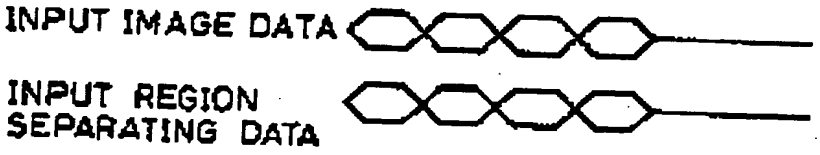


FIG. 24(b)